American Machinist

Volume 55 NEW YORK, OCTOBER 6, 1921 Number 14

The Motor Service Station

The Modern Motor Service Station Is a Machine Shop—Each Branch of the Work Is in the Hands of Specialists—The Toolcrib Is a Necessity

SPECIAL CORRESPONDENCE

NOT so many years ago the average wayside "garage" that flourished in every community center and at nearly every cross-roads was a place of anathema to the passing motorist.

Compelled by force of untoward circumstance to avail himself of its doubtful facilities, the owner of a recalcitrant car could never be certain that his machine would be made to run at all, or, if he was so fortunate as to see it emerge from the "shop" under its own power, he would still be in doubt as to whether or not he would be able to reach home or the next repair station alive and sound of limb.

The logical successor of the bicycle repair shop, its equipment was likely to consist principally of hammers, cold-chisels, wrenches and tools for mending tires, and there was little chance that its personnel would include a trained and skillful mechanic. If there were any machine tools at all the list would begin, and probably end, with an old engine lathe resurrected from the junk heap or dug out of some forgotten corner of a more fortunate machine shop.

It used to be a common saying that "anybody could fix a bicycle," and until bitter experience taught them differently the same idea prevailed with respect to the automobile. However, as the evolution of the machine proceeded, the heavy weights to be sustained, the speeds at which they moved about, and, above all, the ever-increasing complexity of the mechanisms embodied in the modern buzz-wagon taught owner, driver and repairman that to successfully cope with the problems necessitated a thorough understanding of the fundamental principles of mechanics as well as experience in applying them. Thus was the work of repairing and readjusting automobiles lifted from the hand and brain of the "tinkerer" and transferred to those of the trained mechanic and engineer.

The service station, as it is now called, is no longer the habitat of broken-down tools, ignorant and indifferent workmen, and sundry piles of junk, but has become the contemporary of the modern machine shop with its well-ordered array of the latest mechine tools, its system of handling and checking work, and its corps of trained and efficient specialists.

FIG. 1. THE REPAIRING FLOOR, SHOWING THE ARRANGEMENTS OF THE PITS.

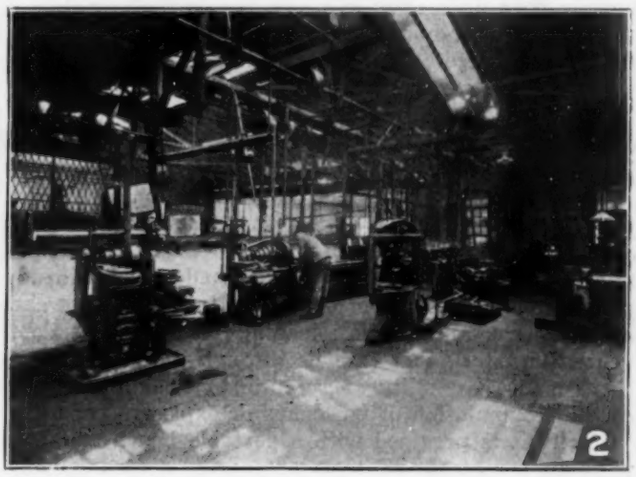

FIG. 2. THE MACHINE SHOP

In the Howard Service Station at New Haven, Conn., where the data and photographs used in the compilation of this article were obtained, when a car comes in for repairs, no matter how insignificant, it is taken in charge by the receiving clerk who enters upon a printed form ticket all the data necessary to the identification of the car, the details of the repair to be made and any other information that may be appropriate to the job.

This ticket is in duplicate, each part with corresponding serial number, and the date and time of entry are stamped thereon by the time clock. The owner or driver who brought in the car and made known the requirements is required to append his signature to this ticket, which is retained in the office and becomes the original order as well as the office record. Thus, when the car is ready for delivery, there is no opportunity for dispute as to what was really ordered.

The second half of the ticket stays with the machine in its progress through the shop and on it are stamped and recorded the time of the various workmen on the job and the nature and amount of material that is used in making the repair. When a job is finished

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FIG. 3. THE BLACKSMITH SHOP. FIG. 4. ELECTRICAL REPAIRING AND TESTING DEPARTMENT

this part of the ticket is filed and thus becomes a permanent record which may be turned up at any time if for any reason it is desirable to know what has previously been done upon a car in the way of repairs.

Minor repairs or adjustments may be made upon the floor of the receiving room but if the nature of the work is such as to warrant it the machine is sent to the department shown in Fig. 1, where is provided every facility for dismantling and overhauling the heaviest car.

Concrete-lined pits radiate in all directions from the turntable at the center of the floor, each pit being of sufficient depth to enable a workman to stand upright under a car and to get at all the under parts to advantage. Provision is made for draining the pits and each pit has an air duct leading to an independent ventilating stack that extends through the roof so that there is no possibility of retaining carbon dioxide or of the accumulation of poisonous or explosive vapors.

Each pit is provided with a portable bench and vise with an equipment of tools ordinarily needed on any job that would come within the range of bench work, and, unless there are parts to be machined, the workman does not have to climb out until his job is finished. Pockets or recesses in the side walls of the pit provide convenient receptacles for tools so that the workman does not have to bend over to retrieve them from the floor.

Electric sockets in the side walls furnish ready means of attachment for extension lamp cords or for electric drills, etc., as may be necessary. Each pit is surrounded at the floor level of the room with a raised curb having rounded outer edges, so that only by reason of the most inexcusable carelessness may a car be run into the pit. An overhead monorail runs entirely around the room and from trolleys on this rail are suspended chain blocks by means of which any car maybe lifted. This overhead suspension leaves the workman's field unobstructed by jacks or blocking and eliminates the danger of dropping a car prematurely by knocking over the supports.

Adjacent to the floor of the repair department is the machine shop shown in Fig. 2. Here are installed engine lathes, drill presses, milling machines, etc., of modern design. Each is operated by a man who is thoroughly familiar with it as well as with the requirements of automobile repair. Gas furnaces with electric pyrometers for controlling the degree of heat are provided for hardening and tempering such parts as require it, as well as grinding machines for finishing the parts after hardening.

The machine room is separated from the repair department by a heavy wire screen partition so that the work of the machinists may not be interfered with by casual visitors. It is well lighted during the day by ample skylights, and auxiliary lighting is provided by

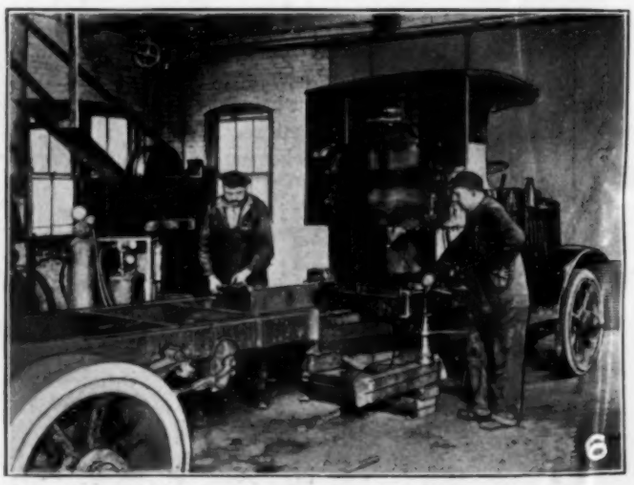

FIG. 5. REPAIRING AND RECHARGING STORAGE BATTERIES. FIG. 6. USING A WELDING AND CUTTING TORCH ON A TRUCK CHASSIS

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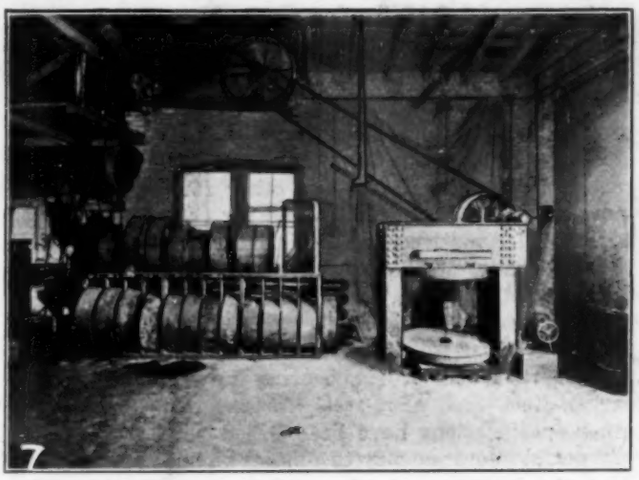


FIG. 7. THE PRESS AND BANDS. FIG. 8. THE TOOLCRIB

shaded electric lights suspended from the roof trusses as well as by individual lamps at the machines.

Each class of work is handled by men who are specialists in their respective lines. The machine work is done by machinists, the blacksmithing by a blacksmith, and all the electrical apparatus with which an up-to-date automobile is equipped is taken care of by an electrician who looks after that part of the work and nothing else.

A blacksmith shop that would do credit to any machine repair shop is shown in Fig. 3. Herein is all the equipment that is needed for welding and straightening parts that have been damaged by collision, and for making small forgings.

The electrician's corner is shown in Fig. 4. The electrical apparatus in a car consists mainly of small delicate instruments and such repairs as are needed may usually be effected without the aid of machine tools. The electrician's bench is, however, located in one corner of the machine room and all the tools of the latter are available if required.

A very essential part of the electric plant in an automobile is the storage battery which furnishes current for the lights when the engine is not running and supplements the generator at other times, and adjacent to the electrician's bench is the department devoted to the repair and maintenance of such batteries. Old batteries are taken down, all parts that are still serviceable are salvaged, and the batteries assembled and recharged, ready for service. Fig. 5 shows this portion of the shop.

Autogeneous welding plays an important part in the repair of damaged automobiles and several portable outfits are maintained in the shop to be taken to the points where they are needed. In Fig. 6 the torch is shown at work upon a truck chassis.

As a large portion of the repair work that falls to the lot of the city service station consists of the large trucks that are in constant service about the streets, it is necessary to make provision for handling the tires of solid rubber with which these heavy vehicles are usually equipped. Fig. 7 shows the massive tire press and the rack of iron bands for confining the tires while pressing them into place on the rims of the wheels.

A feature without which few successful machine shops are conducted is the toolcrib shown in Fig. 8. In this picture may be seen the racks and drawers of tools and supplies that are needed to carry on the work in hand. Each workman is provided with a set of checks which he hands in in exchange for tools needed and thus enables the man in charge of the crib to know just where any tool is that is not in its appointed place.

A stock parts storage is not usually required in a machine shop that is devoted solely to repairs, but in this station all small parts for several makes of cars as well as many parts which are standard to all cars are carried in stock, so that in many cases a substitution can be made that will save much time and expense

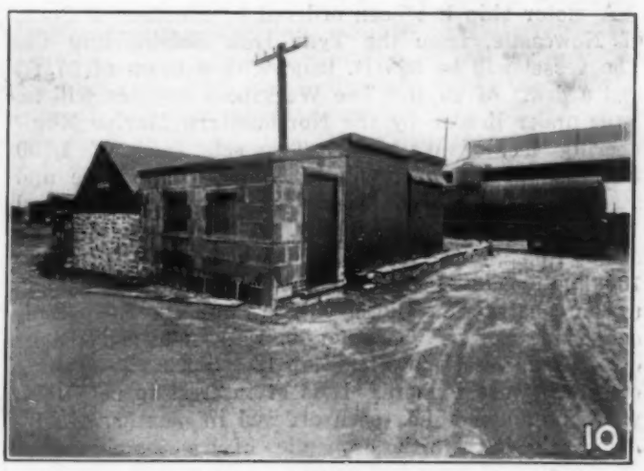


FIG. 9. A BAY IN THE STOCK STORAGE DEPARTMENT. FIG. 10. OIL AND GAS SUPPLY IN THE YARD.

that would otherwise be involved in replacing a broken part with a new one made from raw material. The number of parts in stock runs to many thousands and the view shown by Fig. 9 is but one of the many bays needed to hold them.

Oil and gas are as necessary to the automobile as wheels and where there are at all times so many cars under repairs as well as the increasing number that, in passing, are compelled to stop to replenish their

FIG. 11. A WELL APPOINTED SALESROOM

tanks, it is necessary to have a large supply from which to draw. This oil and gas storage capacity is provided at the Howard station by tanks in isolated buildings at the rear of the yard, many feet distant from other parts of the shop and adjacent to the railroad sidings so that supplies may be unloaded directly from cars to tanks to save the expense of rehandling. The remoteness of the storage buildings, shown in Fig. 10, from any part of the plant where fire and light are necessities, helps to reduce the fire hazard.

A service station does not necessarily sell cars but the salesroom is always a profitable adjunct to the business of repairing and maintaining them, especially in the smaller cities, and therefore a well-appointed salesroom is usually considered to be a part of a similarly appointed service station. In Fig. 11 may be seen a portion of the floor space which the Howard company devotes to that part of the business.

British Motor Ship

A motor ship has been ordered by Hunting & Sons, of Newcastle, from the Tyne Iron Shipbuilding Co. The vessel will be 365 ft. long, with a beam of 57 ft. and a draft of 25 ft. The Werkspoor engines will be built under license by the Northeastern Marine Engineering Co., of Wallsend. Two sets, each of 1,200 indicated horsepower, will be installed, the bore and stroke of the six cylinders to be 560 millimeters and 1,000 millimeters, respectively. The engines will run at 120 r.p.m., giving the vessel a speed of approximately 10½ knots loaded. The Northeastern Marine Co. has under construction Diesel engines totaling 5,400 indicated horsepower. On June 30, 1921, Hunting & Sons owned four vessels, aggregating 16,400 gross tons, three of which were tankers. It is of interest to note that, while no steamer has been ordered in months, a shipowner has faith in the economies of a motor ship, even in a period of very low rates.

Specifications for Steel Forgings

Among the eleven standards of the American Society for Testing Materials now before the American Engineering Standards Committee for consideration and approval are: Specifications for carbon-steel and alloy-steel forgings; specifications for quenched and tempered carbon-steel axles, shafts and other forgings for locomotives and cars; specifications for carbon-steel forgings for locomotives; specifications for quenched and tempered alloy-steel axles, shafts and other forgings for locomotives and cars; specifications for carbon-steel car and tender axles.

Specifications for carbon-steel and alloy-steel forgings are general specifications covering the various classes of carbon-steel and alloy-steel forgings, on which the other specifications have been based with the addition of special requirements to suit the conditions of use. The preparation of these four specifications for forgings dates back to the earliest history of the American Society for Testing Materials. The predecessor of these specifications was the "Standard Specifications for Steel Forgings," which were first proposed in 1900 and adopted in 1901, previous to the organization of the present A. S. T. M. by what was then the American Section of the International Association for Testing Materials. Since 1901 there have been several revisions of the work, notably in 1914 with the cooperation of other technical societies and associations, including the former Master Mechanics Association and the Master Car Builders Association, now the Mechanical Section of the American Railway Association. The work on alloy-steel forgings other than nickel steel was developed in 1915 as an extension of the previous work.

Specifications Revised in 1917

The specifications for carbon-steel car and tender axles, while not included in the forgings series, were developed in connection with this work. In 1914 the committee of the American Society for Testing Materials in charge of these specifications entered into a co-operative investigation with the Master Carbuilders Association, which led to a revision of the specifications in 1917 that harmonized the requirements in the two organizations.

In submitting these specifications for approval by the American Engineering Standards Committee, the American Society for Testing Materials has presented data listing the companies, etc., that use them in their entirety or as general specifications upon which have been based other specifications suited to the particular needs. These specifications have been translated by the Department of Commerce into French and Spanish in connection with the development of foreign trade.

The specifications are submitted to the standards committee in accordance with the special procedure of the committee, under which important standards in existence prior to 1920 may be approved without going through the regular process followed in new work.

The A. E. S. C. would be very glad to learn from those interested of the extent to which they make use of these specifications and to receive any other information regarding the specifications in meeting the needs of the industry.

The revised specifications are contained in the 1921 volume of "A. S. T. M. Standards." Copies may also be obtained from the American Engineering Standards Committee, 29 West 39th St., New York City.

The Economics of Production

VII. PRODUCTION AND WAGES

By Prof. D. A. McCabe, Ph. D.

WE HAVE already discussed the nature of *the employer's* interest in production. We have seen that it is to his advantage that the *total volume* of production in his line be kept down so that the price may be high. On the other hand we have seen that it is also to his advantage that *his own* production be kept up to as great a quantity as he can sell at a profitable price. In as much as he is unable to control the *total* production of his kind of goods and so is unable to keep the price up merely by limiting the quantity produced, he has to make his profit by keeping his costs down below the price that competition forces him to accept. And one way of keeping costs down is to get the largest production possible from each workman during the time that he is at work.

What of the workman's interest in production? Is it to his interest that *his* production be as large as possible during the time he is at work? It is up to a certain point, but there may be circumstances under which it apparently is not. Let us look into this more closely.

Reduced costs of production are to the interest of the employer. They are also to the interest of the public. They are to the interest of the workman also, if they are not gotten through unfair methods of speeding-up the workman and not accompanied by reductions in wage-rates. What we need are systems of ascertaining outputs that both employer and employee recognize as fair, and systems of payment that give a man wages in proportion to his output. Only when production and wages stand in that relation to each other are the interests of the employer, the public and the workman at one in the matter of production.

The employee's primary interest in production is from the standpoint of employment and wages. He likes to see a large volume of production undertaken in lines that call for his class of labor. That makes for a good demand for his kind of labor and that means plenty of employment and good rates of wages. He has the same interest in a good demand for his labor that the employer has in a good demand for his kind of goods. From his own selfish standpoint he is interested in increasing *his own* production only in so far as it tends to *increase* rather than decrease the demand for *his* labor and to *increase* rather than decrease the wages he gets for *his* production.

When I say "from his own selfish standpoint" I mean to pass no unfavorable judgment upon the motives of the worker. He is working primarily for monetary returns for himself just as the employer is. I wish merely to emphasize that it is to *his* interest to increase *his* employment and wages just as it is to the employer's interest to increase *his* profits by reducing *his* costs. Each is in it for his own gain.

The problem is to reconcile these two interests, to harness both to increased production in the plant. To a certain extent the two interests do move together, so long as the worker wishes to work *in that plant.* Increased production per man does reduce costs and lower costs do enable the employer to sell more goods and to give more employment. It is not merely a matter of keeping costs down to those of competitors. Whatever the competitors' costs are, the lower the price at which the goods are offered, the greater the quantity the public will take. Keeping down costs is one way of increasing the volume of production that will be undertaken. On that point the workman's interest and the employer's interest in production are together.

But we must not forget that the workman is interested in *wages* as well as in employment. He is interested in employment as a means to wages. If the increased production is made the occasion of a reduction in wage rates, the workman's interest in it is killed. Not only that, his active opposition to it is aroused. Any wage policy that uses increased production on the part of the worker as a lever by which wage rates are forced down, sets the interest of the employer and the interest of the workman in opposition on the matter of individual production.

It is unfortunately true that the output to be expected from the workman is often a bone of contention. Instead of agreeing on the output after a fair trial in the first place and taking that output for granted in fixing the wage for the average man, so that individual workmen will get proportionately more or less wages for outputs greater or less than the one agreed upon as normal, the output for a given wage is too often established for the moment by jockeying and is known to be subject to change with individual earnings. This puts the workman's interest in wage-rates in opposition to increased individual production. It is not difficult to see that under a system of this kind the wage-earners are not going to pull with the employer for increased individual production.

Reduced costs of production are to the interest of the employer. They are also to the interest of the public. They are to the interest of the workman also if they are not gotten through unfair methods of speeding-up the workman and not accompanied by reductions in wage-rates. What we need are systems of ascertaining outputs that both employer and employee recognize as fair and systems of payment that give a man wages in proportion to his output. Only when production and wages stand in that relation to each other are the interests of the employer, the public and the workman at one in the matter of production.

It should be clear from these articles that production is carried on by co-operation and not by force. What is to be produced and how much is a matter of agreement and accommodation between the producer and the buying public. If the producer asks a high price, he can sell only a small quantity; if the buyers offer a

price below the costs of production, they cannot for long get the goods. Similarly there must be agreement between the workmen and the employer as to the terms on which they are to join in production. If the workers ask too much in wages for the production they give, the employer cannot give them their terms and full employment at the same time. If the employer tries to exact too great production for the wages he offers, he will not get the production.

The employer must accommodate himself to the demands of the public and to what others are willing to do to meet those demands. He must also enlist the co-operation of his employees in production. The employees must make it possible for the employer to produce for costs that will enable him to accept the price he can get for a fair volume of production. The employer, the employee and the demanders must all agree if the game of production is to be kept going. Their interests differ when it comes to the terms to be accepted. But their interests are one to the extent that unless *some* agreement is reached the modern game of producing for sale and buying the products of others with the earning from our own production cannot be played.

A New Practice in International Trade

BY JOSEPH KUCERA

One of the main causes of sluggishness in the international machine-tool market is the unstable money exchange. The customer in Europe is never certain whether he is going to lose or make money on a deal, for by the time he receives the goods ordered from the United States, his country's money may either have gained or lost several points in relation to the dollar, thereby making his purchase a gamble.

On the other hand, the American manufacturer is not very keen to do business in countries where the money may not be worth the paper it is printed on by the time the bill falls due.

During the past two years much has been said, and many attempts have been made toward the stabilization of international exchange, but so far the evil has not been overcome, for all theories and programs were found lacking when applied in practice. In the meantime a new practice in internatonal trade has slowly been developing, or rather, a medieval method has been revived—barter, as a means of international commerce. It flourished particularly during the business boom of 1919 and it was recognized and practiced by the governments of Central Europe in order to overcome the obstacles placed in the way of business by the pyrotechnics of unsettled finance. But the very governments who have done the most business by means of the barter method were glad to see it disappear in the general slump of 1920. They complained that its heavy overhead, due to maintenance of a vast clerical organization connected with it, was an item which Central Europe could ill afford.

Strangely enough, though the business of Europe is just beginning to revive from last year's depression, the problem of barter is again forcing itself to the fore and getting really serious consideration in many quarters in the United States as a medium for international business transactions. This is being deplored as a bad sign for it requires adaptation to methods new to the American manufacturer who feels as if he is making a hundred-year-long step back into history.

"But where does the machine-tool manufacturer come in on barter," asked one of them recently, "is he to load a ship with machine tools and send the skipper out with the goods to look for markets abroad? And supposing he is offered a shipload of sugar for his cargo of machinery, how is he to know where to place the sugar to make a profitable deal?"

This, more than anything else, expresses the curious situation the American manufacturer would face, in case barter in Europe, despite its unpopularity, should work itself into international exchange. You may tell the machine-tool people not to bother about barter and follow their pre-war custom of placing their product in the hands of one or two reliable representatives who will meet their bills in American dollars. Yet, if barter should become an active business method in Europe, the European representatives of the American machine-tool interests will be obliged to carry on selling transactions in this method, which means a higher overhead, and consequently a smaller market than there is at present. The European consumer would have to pay the extra overhead, and while he balked at prices of American machine tools before the war, he may now try to get along without our labor-saving machinery.

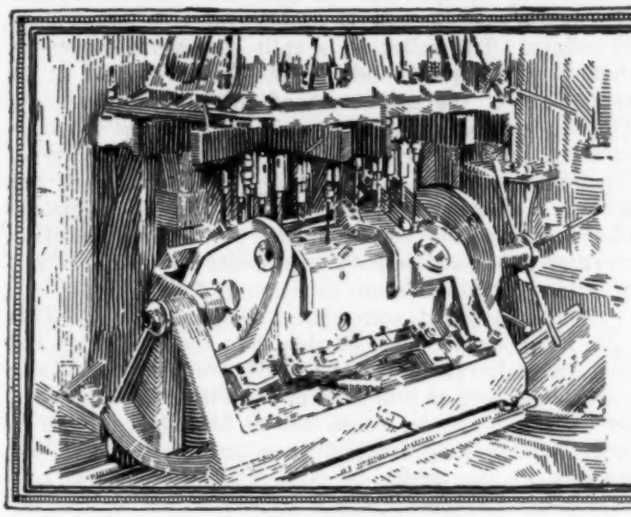
But here we come from theory to practice again. One manufacturer, discounting the above, pointed out the profitable Baldwin locomotive deal whereby the company delivered engines to Roumania in exchange for oil which was sold in England at a good profit, making money coming and going. "This may be all right for a big international organization like the locomotive works," objected another, "what I want to know is, how we, the machine-tool manufacturers, are going to solve the problem of doing business with Europe by barter, if it should prove inevitable in order to do business at all?"

It seems to the writer that we will have to face the the problem. Europe, besides other reasons for not doing business with us, is confronted with the disadvantage of low exchange on the dollar. Modern business, built up on money, sees such monetary disadvantages almost subconsciously and feels them very keenly, whereas, if carried on by barter, it is less conscious of giving more in goods than it would in money.

Such is the situation in Europe. Money in the present transition period, is not regarded internationally as a very desirable commodity. A Czechoslovak is not very keen to possess paper liras, whereas Italians are not anxious to be loaded up with paper marks. The invariable question in international transactions in Europe these days is: what can we get for our corn, or whatever other product we may have in excess?

This psychology in European business is the aftermath of devaluation of money through the war. To this psychology it seems, American business has to adapt itself to some degree.

Since we are considering barter in the interest of the machine-tool trade of the United States and find it such a cumbersome method we may feel inclined, if it should prove to be the only means left for the revival of trade in Europe, to look to other quarters for markets for our goods rather than enter into a proposition so complex that it would require the reorganization of our entire foreign sales department. The fact is, however, that no matter how unwieldy it may seem, we will probably be forced at least to consider barter as a method of trade revival for the simple reason that our domestic markets are overstocked.



Tool Engineering

By
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Turret and Engine Lathe Tooling—Methods of Holding Work—Locating and Supporting Work—Designing for Economy—Factor of Safety

A NUMBER of important matters affecting the design of tools and fixtures for the turret lathe have been mentioned in the previous chapter. The subject is a broad one and the different types of tools considered in connection with their operation on various kinds of work make it necessary to deal with specific cases as they may be illustrated. In every machining operation we must consider first the work and the method of holding it; second, the tools used; third, the machine movements and operation. We shall take up first the method of holding work of various kinds because it is logically the first step in design.

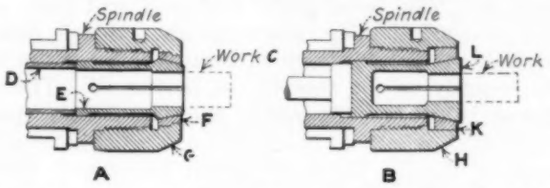

FIG. 216. PUSH-OUT AND DRAW-IN TYPES OF COLLETS

Chucks and Collets

When a piece of work is of regular form it is usually held in chuck jaws or by means of collets. In either case the work is gripped by means of jaws which are contracted or expanded by means of the chuck or collet mechanism. On automatic and hand screw machines production work from the bar is commonly held in collet jaws. If the work is a forging or casting or if it is "cut-off stock" it may be held by means of chuck jaws. For the purpose of discussion we need not consider in detail the many varieties of chucks and collets which are in use. It is, however, necessary to understand something of the working of both devices in order that the design of special jaws may be made clear.

Strictly speaking there are two forms of collets, one of which operates with a "push-out" movement and the other with a "draw-in" motion. These two forms are illustrated in Fig. 216. The example at *A* shows the push-out type while that at *B* is the draw-in type. The work shown at *C* may be a bar of stock which extends entirely through the spindle or it may be a short piece, according to the conditions of manufacture. In operation, the sleeve *D* is moved forward by means of a lever at the head end of the machine, thus forcing the collet *E* forward into the taper bushing *F*, which is mounted in a nose-piece *G* on the end of the spindle. As the collet is moved forward it contracts and grips the work firmly.

In the example *B* the operation is just the reverse. It will be seen that the nose-piece *H* is furnished with a bushing *K* into which the collet *L* is drawn back, thus contracting it on the work. In each of the cases shown the collet is of one piece which has been split in several places to permit it to expand and contract as controlled by the taper at the end. Both of the collets shown in the preceding illustration have a certain amount of end movement which may possibly affect the holding of work which has been previously finished. In other

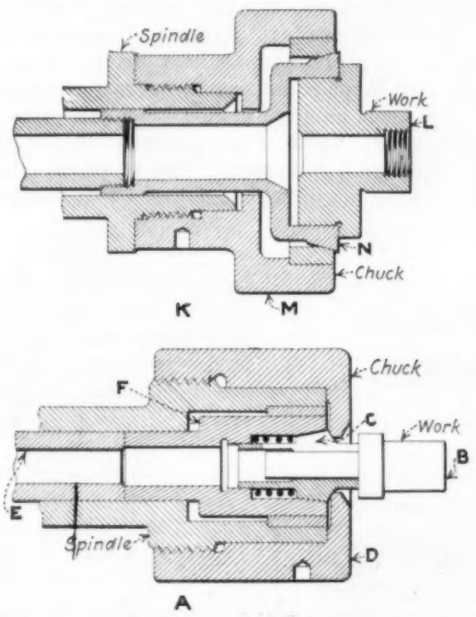

FIG. 217. COLLETS WITHOUT END-MOVEMENT

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words slight variations in the diameter which is being held will cause a variation in the position of the work with respect to the end of the spindle.

A type of collet which does not have any end movement is shown in Fig. 217 at *A*. In this type the work *B* is held by means of three loose jaws *C* which are provided with retainers in the chuck body so that they will not drop out A nose-piece *D* fits the end of the spindle and keeps all of the parts in place. The collet is closed by means of a sleeve *E* which pushes forward a tapered member *F*, thus closing the jaws. The construction of the chuck is such that there is no appreciable movement forward or backward when the device is operated. It is therefore possible to locate work accurately against the end of the collet so that it will always be held in a certain relation to the end of the spindle.

In the example *K* the work *L* is a casting of such size that it can not normally be held in a collet. However, it is possible to grip work of this kind in a special oversized type such as that shown. This device is operated in the same manner as the draw-in type shown in Fig. 216. The nose-piece or chuck *M* is larger than the standard form and the collet *N* is split in several places so that it will contract and expand as controlled by the tapered portion.

There are other forms of collets adapted to particular kinds of work but as these are more or less specialized they will not be illustrated here but will be taken up in detail later. It is possible to form out a set of collet jaws for a given piece of work and it may be profitable to do so when work is made in large quantities. As a general thing, however, pieces which are slightly irregular are more likely to be adapted to a two-jaw chuck in which the jaws are formed to fit the contour of the work.

Step Chucks

In Fig. 218 is shown another application of the collet principle to work which is so large that it cannot be held in the regular form of collet. Devices of this kind are called "step chucks" because they are frequently "stepped out" to various diameters so that several sizes of work can be held in the same chuck. Although used largely for second operation work where pieces have been partly finished, they are also useful in holding rough work, when castings or forgings do not vary greatly in diameter. Two types are shown in the illustration, one of which *A* has a soft spring collet

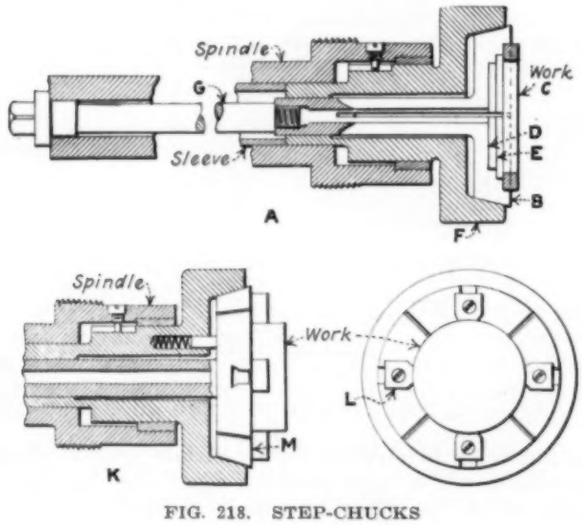


FIG. 218. STEP-CHUCKS

B which is "stepped out" to hold the work *C*. It has also been bored out at *D* and *E* for two other sizes of collars. The collet *B* is split in several places so that it will expand and contract readily when it is controlled by the movement of the sliding closer *F*. This is operated by a lever at the end of the machine in the same manner as a collet of the ordinary type. The rod *G* extends through the spindle and holds the portion *B* in a fixed position endwise. Therefore chucks of this nature are very desirable for second operation work as it is possible to always locate the piece so that it is in a certain relation to the end of the spindle.

Another type of step chuck is shown at *K*. This type is somewhat more flexible than the one which has just been described because it is provided with loose adjustable jaws as indicated at *L*. These jaws are soft, so that they can be bored out to fit a given piece of work, and as they are easily replaced with others, the up-keep of the device is excellent. The general construction and operation are similar to the one shown at *A* but for some classes of work it is not as good as the former type. For example, if a piece of very thin work were to be held with considerable pressure it would undoubtedly be distorted due to not being properly supported. It is possible, however, to make up special jaws for a condition of this kind so that the jaws will act as large segments of a circle and thus envelope the work so that it will not tend to distort, even if it were quite thin. If necessary, special jaws of this kind can be so made that they will form segments of nearly 90 deg., although when this is done it is advisable to provide them with extra setscrews to hold them securely on the face of the portion *M*. The tool designer is not usually called upon to design special

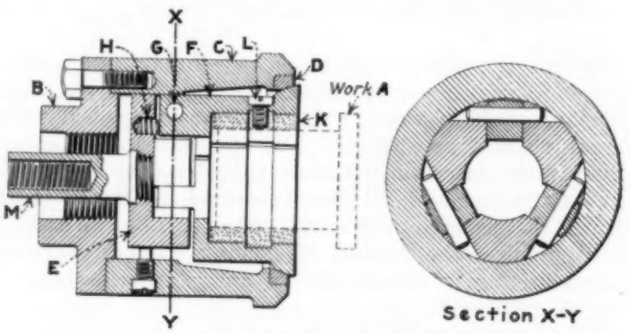


FIG. 219. SPECIAL COLLET WITH ROCKING JAWS

jaws for step chucks, but the methods used are interesting and should be thoroughly understood so that special forms may be applied when necessary.

In Fig. 219 is shown a special form of collet designed for the work shown at *A*. This device is quite different from any of those previously shown, yet its functions are somewhat similar. A special nose-piece *B*, is screwed to the end of the spindle as indicated, and a chucking ring *C* is suitably mounted on the nose-piece. A hardened ring *D* is inserted as shown, this ring being bored out to a taper of 15 deg. The inside of the chuck is fitted with a holder *E* in which are three jaws *F* pivoted on pins at *G* and held open normally by means of stiff coil springs *H*. Special inserted jaws *K* are held in place in the movable members by means of screws shown at *L*. These jaws are bored out to suit the work that is to be held. The entire mechanism is operated by means of a rod which passes through the spindle and connects with the sleeve *M*, the latter

being screwed into holder *E*. The chuck is operated by means of the collet mechanism usually provided on screw machines.

There is a slight objection to this type of holding device on account of the rocking action of the jaws. In holding finished work this would not be likely to cause trouble, but on rough work where considerable variation may be found, the holding might not be uniform unless a slight float were to be permitted at the pivot point *G*, so that the jaws could align themselves with the work and take care of normal inequalities or variations.

Inside Holding by Means of Collet Mechanism

Work is occasionally found which requires holding by the inside and in many cases a two- or three-jaw chuck is used for the purpose. There are cases when another method may seem advisable if the work is small

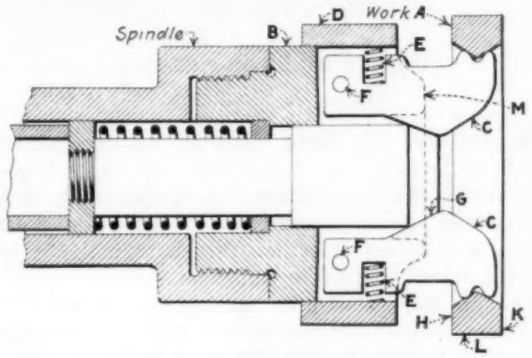


FIG. 220. SPECIAL INSIDE HOLDING DEVICE

so that it cannot be easily adapted to a chuck. An example of this kind is shown in Fig. 220, in which the work *A* is a ring having an angular inside surface. In order to provide a rapid method of handling, the device shown was applied with good results. The spindle of the machine is fitted with a sleeve *B* which is slotted in three places to receive the special rocking jaws *C*, which are three in number. A steel collar *D* is fastened to the outside of the sleeve *E* in such a way that it covers the slots and also provides for the thrust of the coil springs at *E*. The jaws *C* are pivoted on pins at *F* and they are tapered on the inside to conform to the angularity of the plug *G*. The operation is controlled by the collet mechanism in the usual manner, the tapered plug *G* forcing the jaws *C* outward so that they grip the inside of the work firmly.

An advantage of this type of holding device is that it permits facing the work on both sides *H* and *K* in the same setting, and also permits the turning of the outside diameter *L*. It would be possible to extend the sleeve *B* somewhat further than the point *M* if the nature of the work would permit it and this might be an advantage in that it would give the jaws a better support. It depends upon the nature of the work and its general construction and the designer must be governed accordingly.

Two-, Three- and Four-Jaw Chucks

Chucks having three jaws with a universal movement about the center are largely used in production. The fact that all three jaws operate simultaneously and with a uniform movement is an important item when work is to be centrally located. The two-jaw chuck is also a favorite in holding work of small size for production. This type of chuck is also commonly made so that the movement of the jaws is uniform about the center. A chuck having four jaws operating independently is not often used for production work, although there are cases when it may be found necessary. Fig. 221 shows a diagram of the three varieties of chucks mentioned. The two-jaw chuck shown at *A*

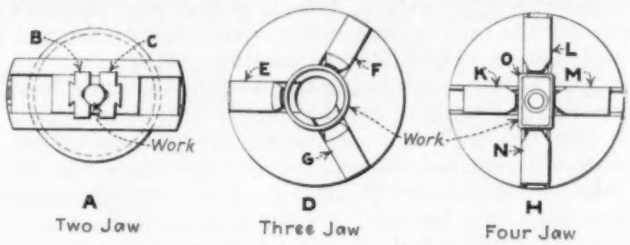


FIG. 221. TWO-, THREE- AND FOUR-JAW CHUCKS

is usually so made that special jaws can be inserted in a dovetail slide as shown at *B* and *C*. These are often called "slip-jaws." This variety of chuck is operated by means of a right- and left-hand screw which sometimes passes through the center of the jaws and at other times is at one side. For any work which is long it is necessary to select a chuck having an operating screw at one side of the center, so that the work can extend back and not interfere with the screw. The majority of manufacturers who deal in these chucks can supply them either way. The three-jaw chuck shown at *D* is a prominent factor in production work, as the three jaws *E*, *F* and *G* are uniformly arranged about the center so that when in operation they exercise a centering action on the work. Different methods of controlling these jaws are used, but a common method employs the use of a scroll ring which engages with grooves cut on the under side of the jaws. As the scroll is revolved the jaws are drawn in or out according to the direction of the movement.

The four-jaw chuck shown at *H* has its jaws arranged at 90 deg. from each other as at *K*, *L*, *M* and *N*. Each of these jaws is operated independently by means of a screw. In using a four-jaw chuck for production work it is common practice to allow two of the jaws to remain fixed so that they act somewhat as a "V." In the case shown we can consider that the jaws *L* and *M* are stationary and the work *O* is located in position and clamped by the action of the two jaws *K* and *N*. When a chuck of this kind is used for other than production work, it is necessary to adjust the jaws separately and "indicate" the work until it is found to be in a central position.

There are various methods of operating both two- and three-jaw chucks, although those mentioned are commonly used. The air-operated chuck is used very largely for rapid production and there are other types which are operated by means of cams. The particular method of operating the chuck, however, does not concern the tool designer to a great extent except as he may be required to select the chuck for a given operation on a piece of new work. It is advisable for him to become familiar with the methods of operating and the advantages of the various types in order that he may be better able to judge which particular type is most suited to any given piece of work.

In the design of special chuck jaws there are a number of important points to be considered. The nature of the work, its general shape, the material of which it is composed, the thickness of the casting, the position of any letters or figures on the outside of the casting,

the parting line, the angularity of the work caused by the draft and possibly some other matters, all have a bearing on the method of holding. In addition to these points, the cutting which is to be done and the various surfaces which are to be machined must be taken into consideration. No matter whether the work is to be held in a two-, three- or four-jaw chuck or whether the casting or forging is regular or irregular, the following points must be carefully noted:

(1) Chucking; in placing the work in the chuckjaws, care must be taken to see that proper provision is made so that two men will not be required to set up the work, viz.: one man to operate the chuck jaws and the other to hold the work in position. If a condition should arise such that the casting could not readily be placed in position and locked securely by one operator, it would be necessary to provide a special chucking device on the turret of the machine to hold the piece in its proper position while tightening the chuck jaws.

(2) Location and support; in locating the work in the jaws, attention must be given not only to a proper method of holding but also to the points that are to be machined so that a locating surface will be selected such that subsequent operations will be considered in their relation to the accuracy required in the product. It is advisable to select points both for holding and locating which will not be likely to be affected by patternmakers' figures or letters, and the gripping points must be so arranged that they will not strike directly on any seams or "fins" on the casting. In supporting the work, the pressure of the cut and its direction as well as the possibilities of pulling the work out of the chuck under very heavy cutting must always be thought of. When wide surfaces are to be machined, proper support should be given to them so that they will not "buckle" under the stress of the cut. Other matters connected with the location and support of the work will be taken up subsequently as hereinafter illustrated.

(3) Driving; if the piece of work that is to be held is thin or fragile, it is well to provide a means of driving so as to take the strain away from the jaws and not make it necessary to set these up too tightly. It is often possible to use a projecting lug on a casting as a driver, letting it rest against the side of one of the jaws. In exceptional cases it is permissible to drill a driving hole in some part of the work, the hole being so placed that a pin in one of the jaws will act as a driver in the hole. The method of "serrating" the jaws is an important factor in driving the work, but the serration must be proportioned properly in order that the points will grip the work and yet not become dulled too easily.

(4) Distortion; no matter what kind of work is being held in chuck jaws (except, of course, solid stock), there is always a possibility of distorting the work by applying too much pressure on the jaws. Careful consideration should therefore be given to this matter when designing chuck jaws. In very heavy work there is not much danger, but when pieces are thin, the greatest care must be used. The matter of distortion will be discussed more fully in a subsequent chapter.

(5) Economy; the cost of the fixture does not necessarily govern its economy; it is possible that although it appears costly, the saving in setting up and removing the work is sufficient to counteract the extra cost of the fixture. Naturally, it makes a great difference whether a small or a large quantity of pieces are to be machined. In the latter case any saving in the time of setting up will result in a greater production and consequently less unit cost. For high production tools, provision should be made for replacing worn or broken parts with the least possible expense. All locating points and other parts subject to great wear should be so made that they can be readily replaced.

(6) Safety of the operator; in turret and engine lathe work, the holding fixture or chuck revolves and therefore the greatest care should be taken that there are no projecting points or parts which might catch on the operator's clothing and endanger his life. Setscrews which project are very bad and can generally be avoided by the use of the hollow type of screw. Clamps should be properly guarded and any other parts should receive the same careful consideration. In some cases on large work, it is necessary to build a special guard in order to make sure that there will be no danger to the operator.

Abuse of Free Service

BY C. J. MORRISON

The question of abuse of free service which is treated editorially on page 361 of the *American Machinist*, is one that should not be difficult to handle. No reputable manufacturer wants to sell a machine containing a defect and then refuse to make it right. If he did, his business life would be short.

Although the automobile manufacturers hold themselves responsible only for defective parts and claim to charge the owners for the labor of tearing down and reassembling, few of them follow this practice in cases of real defects. However, the clause in the contract gives a good protection against unjust claims.

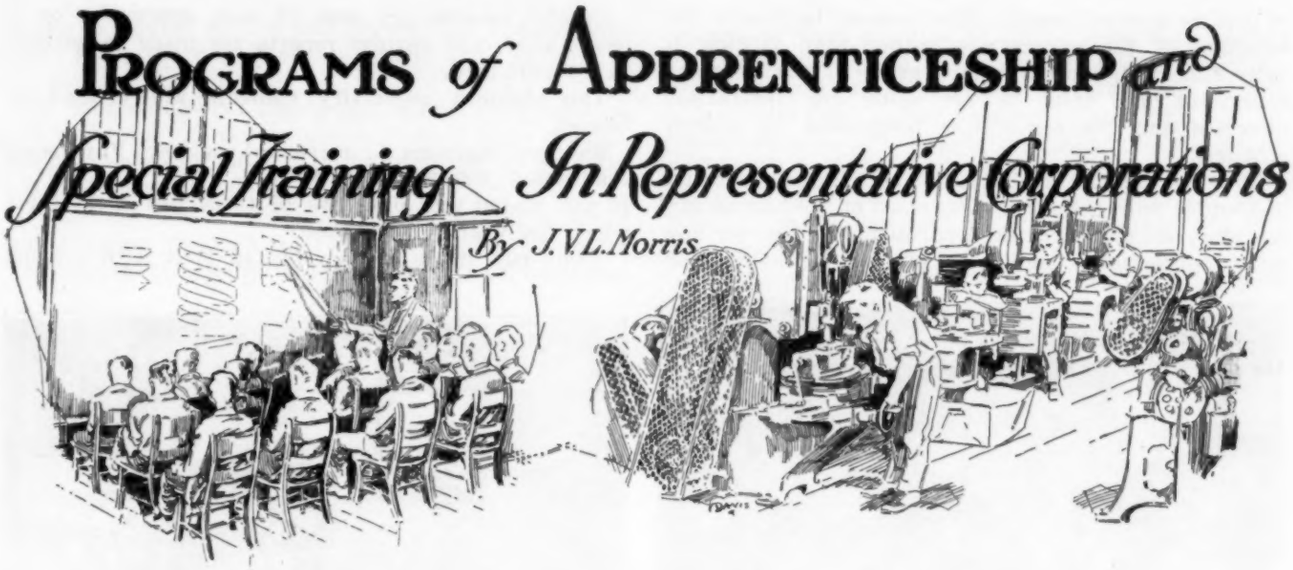
A few years ago one automobile manufacturer went so far as to ask his customers to bring in cars of a certain model in order that new rear axles might be applied at no expense to the owners. The factory had discovered a defect in the design and considered it better policy to replace the axles at once than to allow them to fail in service. Had they attempted to charge for the labor of replacing these axles, many owners would not have had them replaced and the reputation of the car would have been seriously injured.

This year one well-known automobile company had difficulties in the painting department and as a result is repainting, free of charge many of its cars. Had this company furnished the paint and charged for the labor the result would have been a number of very much dissatisfied owners and considerable bad advertising.

Machine-tool builders can scarcely do less than these automobile manufacturers and make good their own defects. However, they can and must protect themselves against unjustified claims. All that is necessary is to take a firm stand and refuse to give free service except where it is justified by defects in the machines. It is usually easy to determine whether trouble is due to a defect or to abuse or ignorance and as most machines are sold to honorable concerns, there should be little difficulty in determining who is to foot the bill. However, as almost everyone is willing to take all he can get for nothing, the abuse of free service will continue until the machine-tool builders stop it. The remedy is in their own hands and they can continue to give unjustified free service or stop the practice just as they choose.

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



XV. The National Cash Register Co., Dayton, O.

Co-operative Apprenticeship for Boys and University Students—Upgrading Course for Salesmen and Repairmen—Health and Safety Instruction—Evening and Noon-Hour Classes

THE National Cash Register Co., has a country-wide reputation for its welfare work. Such phases of its work as may be considered as primarily employee training and education are not so well known. They will be discussed under the following headings: (1) Apprenticeship; (2) upgrading courses; (3) health and safety education; (4) evening instruction.

Apprenticeship

An elaborate scheme of apprenticeship has been laid out, mainly on the co-operative principle, which may be extended by a university course in engineering. The plan calls for the completion of two years of high school work previous to entrance. The boy who has made normal progress should then be at least sixteen years of age, as required by the indenture agreement, and be well prepared to enter upon the apprenticeship which he is to pursue for two years on the co-operative basis, one week in school and the next at work in the factory. It is then expected that he will have completed high school. The alternatives are then open to him either to complete his apprenticeship in two years with part-time instruction one afternoon a week, or to follow a five years' course at the University of Cincinnati on a co-operative basis.

The co-operative high school in which the apprentices embark on their apprenticeship by attendance on alternate weeks has some unique features. It is in session throughout the year for fifty weeks so that the boys have twenty-five weeks of instruction with their twenty-six weeks of practical work at the plant, thus providing for only one week of vacation each year. Moreover, the school is in session for seven hours a day, five days a week. On Saturday mornings of their school weeks, except during the months of July, August and September, the boys report to the plant for special instruction in which they are addressed by company officials or shop foremen on shop methods, factory systems and like topics. As these meetings are in the factory school building, which is equipped with moving-picture apparatus and reflectoscope, the subjects presented can be very effectively and entertainingly developed. The instruction is intended to co-ordinate the school and shop work.

The course of study at the school seems well laid out for the purpose, providing instruction in mathematics, history and civics, drawing, English, shop practice, physics and chemistry. A class receiving instruction in shop work is shown in Fig. 61.

The work in the plant is supervised by a thoroughly experienced mechanic, who superintends the transfers from one department to another and sees that the opportunity is provided for all types of practice.

This practice has been laid out with a great deal of care and a printed chart drawn up which is practically a complete trade analysis, calling for a fixed number of months at each operation. This chart is placed in the hands of all the foremen concerned, with the requirement that it be rigorously followed in order to assure the complete acquisition of the knowledge

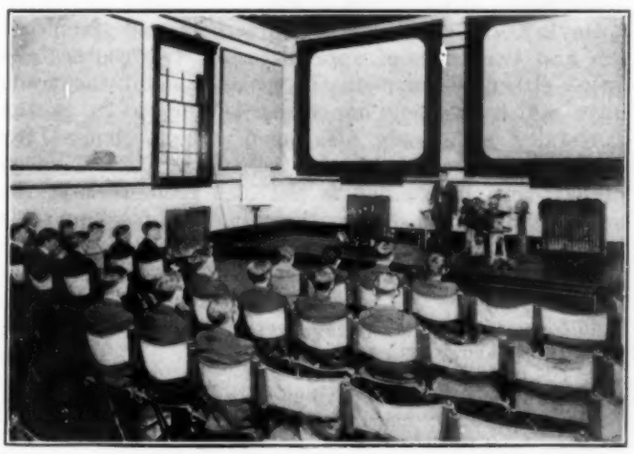


FIG. 61. CLASS OF APPRENTICES RECEIVING INSTRUCTION

of the respective trades. The system facilitates the handling of the apprentices, rather than making it more difficult, because a definite group of machines and operations can thus be set aside for instruction purposes and the apprentices progressed by orderly schedule.

Previous to the inauguration of the co-operative apprentice course, a survey was made of the toolmaking, machine, and modelmaking departments to discover how many apprentices could be satisfactorily provided for.

FIG. 62. LEARNING TO REPAIR DIFFERENT TYPES OF REGISTERS. FIG. 63. CLASS OF SALESMEN

Based upon this investigation, the following quotas were established:

Tool making department, 20 apprentices.
General machine department, 16 apprentices.
Model-making department, 16 apprentices.
Special machine department, 4 apprentices.

As there is a hierarchy of trades in this field, toolmaking being given chief place, an incentive to extraordinary effort is given by promising that any vacancies in the quota of that department will be filled by transferring from other departments. Also, as tool designing offers superior opportunities to the other branches, apprentices to that department are obtained by selecting the most promising young men from the four departments already mentioned.

Having graduated from high school and completed the first two years of apprenticeship, two courses are open—either to complete the acquisition of the trade upon which the boy has embarked or to go to the university, as already mentioned. If he chooses the first plan of continuing in the trade, one afternoon of part-time instruction is provided each week at the school in drawing, shop mathematics and machine tools and a quarter of an hour of health instruction.

The present enrollment based on the program is as follows:

40 co-operative half-time apprentices.
21 third- and fourth-year apprentices.
18 co-operative university students.

The apprentices are distributed as follows: Toolmakers, 46; draftsmen, 6; machinists, 5; electricians, 2; patternmakers, 1. Total 60.

The boys in the first group of co-operative apprentices are paid 27½ cents per hour for the time that they are working in the shop, with increases of 2½ cents per hour every six months up to their third year. After that, they are paid what they are considered worth. This was stated to be usually around 50 cents an hour, with a fifty-four hour week. There is no piece work throughout the course.

Careful records are kept of each apprentice on a record card, and regular reports are made to parents on a report card.

The eighteen university students are divided as follows:

Electrical engineers, 5; mechanical engineers, 9; chemical engineers, 2; commercial engineers, 2.

It was stated that only two or three had spent their whole five years in the plant.

Their pay starts at 35 cents an hour with gradual increases, so that for the third, fourth and fifth years it is 45, 47½ and 50 cents an hour, respectively.

Records were stated to show that so far 49 per cent of the apprentices, on completing the course, stay with the company.

The provisions for training repairmen and salesmen offer interesting examples of upgrading or promotional training, being the second form of training provided. Of the repairmen there are at present 140 following the course, which is ordinarily ten months in length, although if any young man exhibits extraordinary adaptability he may graduate in as brief a time as five months. The system of picking the best trained to be transferred to regular work irrespective of the length of training acts as an excellent spur to attentive work.

Those chosen for the course are carefully picked, as the company is placed at considerable expense in bringing each one up to the desired skill. Many of them are chosen from the assemblers in the plant and some of them are sent in from the company's branch offices.

The age limitations are twenty-one to twenty-five and single men are preferred. The pay while learning is fixed at the uniform rate of $25 a week.

Instruction is provided by an instructor, an assistant instructior and an inspector for each group of twenty-five men. The work is sufficiently rigorous, so that it is expected that 50 per cent of the men will be eliminated before completing the course. Each separate device of the product is taught, and then the assembling of the various models. It adds considerably to the extent of the course that construction of discontinued as well as modern models must be learned as, of course, all types are met in actual practice. After the preliminary instruction is covered, the students spend their time, as shown in Fig. 62, in repairing and rebuilding machines sent in for the purpose. They do this until they are considered competent.

The supplementary instruction consists of an hour

a day of motion-picture and stereopticon lectures. In them are presented all phases of the work as fully as possible by that means.

Of course there is a steady demand for the graduates, and many find the work a stepping stone to an appointment as salesman, so that an opportunity to take the course is eagerly sought.

Somewhat similar methods are followed in the school for salesmen, although the course is briefer. Men for the purpose are selected largely by the district managers and put into the field for three months, six months or a year. If the district manager then decides that a man is satisfactory material, he is admitted to the school.

Three sessions are held yearly, with the size of each group limited to fifty men and the length of the course to five weeks. Students' expenses except transportation are borne by the company. The school is in charge of one instructor who is an experienced salesman. There is a carefully prepared course of study which is closely followed. A class in session is show in Fig. 63. Written examinations are given to assure that the men work, while diplomas are awarded to show that they have completed the course. After completing this instruction the men return to the position they came from, with the expectation that improved sales will justify the time and cost of the course.

From 1903 to 1908 the policy of the company was to take new men who had made a success of their previous business, put them in school to teach them salesmanship of the company's products, and then put them in the field. As a result, but 26 per cent made good during that period. In 1908 the new policy was adopted of trying the men out in the field before putting them in the school. Some men do not like the business and quit before they get to the school. Others the sales managing force does not find desirable and they are allowed to go before getting into the course. Under this policy 78 per cent of the salesmen who have gone through the course are successful.

All progressive companies, particularly under the operation of employer's liability laws, are devoting increased attention to the installation of safety devices and to publicity campaigns to warn employees against dangerous or unsanitary practices, in all of which this company has been a pioneer.

The company has, moreover, realized that chronic or temporary ill health or low vitality of an employee represents a loss to the company through absences and reduced production when at work. Therefore, it has devoted a great deal of effort and money to health education as a means of reducing these losses. There is a health and safety committee composed of representatives in each department. Departmental safety committees hold regular meetings to discuss problems relative to this matter; and Fig. 64 shows the committee from the company garage talking over its own safety rules.

Twice a week there is provided a lecture or talk on health and safety which new employees are required to attend. The lectures are illustrated by moving pictures and stereopticon. In them are explained the assistance provided by the company toward promoting a healthful community and good working conditions: the visiting nurse, the free dental clinic and first aid facilities. As safety instruction, concrete cases are mentioned of instances which have occurred in the plant where serious results have attended the failure to utilize the accident prevention measures.

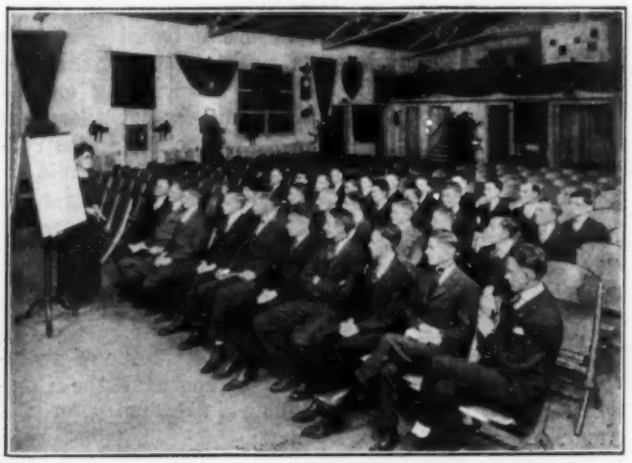


FIG. 64. A DEPARTMENTAL SAFETY COMMITTEE IN SESSION. FIG. 65. A NIGHT SESSION OR "OWL CLASS"

The lecture is also considered a favorable time to present other aids to the health and comfort of employees. Among these are bathing facilities, dining halls, the company's extension educational facilities, relief associations and provisions for employees' social life.

Other lectures are frequently provided on special phases of hygiene as a part of the evening extension education of which a description here follows.

Evening and Noon Hour Instruction

Evening instruction, the fourth form of training, has for a long time been provided under the caption of "owl classes," one being seen in Fig. 65. They are noteworthy, not so much on account of their variety or numbers in attandance, as for the definiteness and practicality of the instruction. Altogether there are twelve courses provided, with four to five hundred registering each year. There is a course on advertising and printing for the printers and pressmen, another is in accounting, a third is in agency office practice, while mechanical drawing and shop mathematics are provided for those who wish to advance themselves in the shops. Courses in salesmanship have been particularly useful in aiding employees to enter that field. Other offerings are public speaking, home economics and a Spanish class. A former residence of the company's president provides the down-town center for these classes.

At the plant a class for male stenographers has also been provided from four to five-thirty in the afternoon. This was attended by about forty.

Alongside of the factory there is the company's "schoolhouse," which contains an auditorium seating 1,200 people. Here noon hour or evening movies or lectures are provided daily. Probably the chief value of this entertainment is the diversion provided, but it has been a convenient means for reaching the employees in the matter of health, community improvement by landscape gardening and the like.

As regards the matter of intensive training in this plant no vestibule schools are maintained, but the idea is part of the recognized scheme of training on the departmental basis. Throughout the factory there are seventy-two "try-out" men or girls, who act as instructors as well. Each of them is a skilled mechanic or operative and part of their duties is to aid the operatives in bringing their work up to standard production.

Eye Accidents as a Cause of Waste in Industry

Eye accidents are revealed as a chief source of avoidable national waste in a special report of the Committee on Elimination of Waste in Industry of the American Engineering Council which has just been made public. The report embodies the results of an investigation conducted in many states in connection with the assay of waste in basic industries started by Herbert Hoover.

The total number of industrial blind in the United States is given as 15,000, or 13.5 per cent of the total blind population, "this type of injury being the leading causative factor of blindness," according to the report which was prepared by Earle B. Fowler. The eye, it is declared, is involved in 10.6 per cent of all permanently disabling accidents.

The continuing sacrifice is shown to be very large, asserts the committee, which blames irregularity in reporting the facts as to number, severity and time loss for incomplete knowledge of the situation.

Present protective methods as applied in large plants have effected a great reduction in injuries, it is stated. The use of goggles is one of the chief protective devices. In the plants of the American Car and Foundry Co. there has been a reduction of more than 75 per cent through the use of goggles. Experience has proved, it is declared, the falsity of the theory that the wearing of goggles by industrial workers in the event of accident only jeopardizes sight the more, on account of the liability of injury to the eyes from the broken glass of the goggles.

Not a single case of injury to the eyes from broken glass has been recorded since goggles were introduced into the shops of the New York Central Railroad. All employees of the Union Pacific Railroad Company are now required to wear goggles on eye dangerous work.

Striking reduction in eye accidents is shown by the American Locomotive Company. The number of accidents requiring medical attention in the company's plants was 52 in 1915, while during 1910-13 it was 448. In 1915 only two eyes were lost, while during 1910-13 the loss was 10.5. The number of injuries per 1,000 full-time men per year was 15.7 in 1915, while in the 1910-13 period it was 38.9. In the American Steel Foundries the proportion of eye accidents has been reduced 85 per cent.

"Basing judgment on the experiences of the concerns making these and similar reports," the report said, "it is evident that the continued loss is at least partially preventable and due to failure to apply protective measures rather than to any fault in the measures themselves as they have developed."

In spite of very definite and severe tests laid down by the National Code, the report says, the knowledge regarding the characteristics of adequate protection appears to be definitely limited to a few, mainly those responsible in the larger organizations. The report declares that "false statements or the sale of goggles under misrepresentation that they meet all of the specified requirements of the codes, introduces a grave menace." A certain number of accidents involving damage to the eye are still unavoidable, it is said.

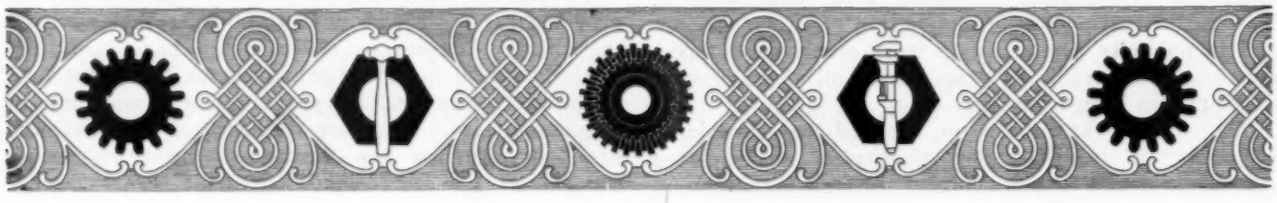
The report also charges industrial waste to subnormal vision and faulty lighting.

The report stresses the importance of correcting subnormal vision among employees saying that excess eye fatigue results in conditions which must produce a time labor loss from reduction in quantity and quality production. One investigation showed that out of 2,906 garment workers only 743, or a little over 25 per cent, had bilateral normal vision, 17 per cent having normal vision in one eye, with the other defective.

An examination of more than 10,000 employees in factories and commercial houses found 53 per cent with uncorrected faulty vision. Of 675 employees in a typewriter company, 58 per cent were found to be in need of correction by glasses. An examination of the vision of 3,000 employees in a paper box factory in Brooklyn, N. Y., showed that the percentage of normal was only 28. In every group of workers examined there were a large number who fell below the line and this number becomes appreciably greater if those who have subnormal vision are taken into account.

One estimate, the report stated, placed the loss due to faulty conditions in this country as above the entire cost of illumination. In 446 plants investigated only 8.7 per cent were found to be in excellent condition, the other ratings being: Good, 32 per cent; fair, 29.1 per cent; poor, 18.8 per cent; very poor, 3.5 per cent; partly good, partly poor, 7.8 per cent.

The Committee on Elimination of Waste in Industry is composed of J. Parke Channing, chairman; L. W. Wallace, vice-chairman; L. P. Alford, George D. Babcock, William R. Basset F. G. Coburn, Morris L. Cooke, Harrington Emerson, Ira N. Hollis, Edward Eyre Hunt, C. E. Knoeppel, Robert Linton, Fred J. Miller, H. V. R. Scheel, Sanford E. Thompson, John H. Williams and Robert B. Wolf.



Special Fixtures in the Peerless Shop

Milling Fixtures for Continuous Work—Fixture for Grinding Ball Ends—Radius Milling and Threading—Drilling Connecting Rods

SPECIAL CORRESPONDENCE

A NUMBER of interesting fixtures used in machining various parts of the Peerless car are shown in the accompanying illustrations. In almost every case these ideas are capable of being adapted to many other kinds of work, the same principles lending themselves to various machining operations.

A double-ended milling fixture which enables the cutters to be at work almost continuously, is shown in Fig. 1. This fixture is for milling the forked ends of clevises used in connection with the foot brakes. The total width of each clevis is $\frac{3}{4}$ in. and the width of the slot $\frac{11}{16}$ in., which gives a good idea as to the size of the fixture and the cutters used.

Four clevises are held at each setting, each clamp holding two as at *A* and *B*. The fixture is arranged to be easily indexed after being run back out of the cut. It will be noted that both jaws of the clevis are firmly supported against the downward thrust of the milling cutters.

Another part of the brake, the pedal extension, is being milled in Fig. 2. This part is considerably larger than the clevis, being approximately 7 in. long and the slot over 3 in. in length by $\frac{1}{4}$ in. in width. The length of the slot requires a comparatively large diameter saw or milling cutter as can be seen. These pieces are milled in pairs, being held by the three separate clamps *A*, *B* and *C*.

Grinding the ball for the steering knuckle arm is shown in Fig. 3. The stem is held in the draw-in chuck at *A* and is revolved by the small round belt shown at *B*. The head which carries the ball is pivoted at *C* and is moved around the track *D* by the handle *E* giving an easy and positive control in any position.

The milling fixture shown in Fig. 4 is used in finishing the round end on the lower portion of the change gear lever. The lever is previously drilled, the hole fitting over a pin and the end being supported by the stop *A*. The lever is clamped both at the end *B* and on the round portion *C* by means of the double-acting clamp shown. The cam *D* forces the block beneath it down on the rounded part at *C* and also clamps the end at *B*. This clamp is quick acting and equalizes the

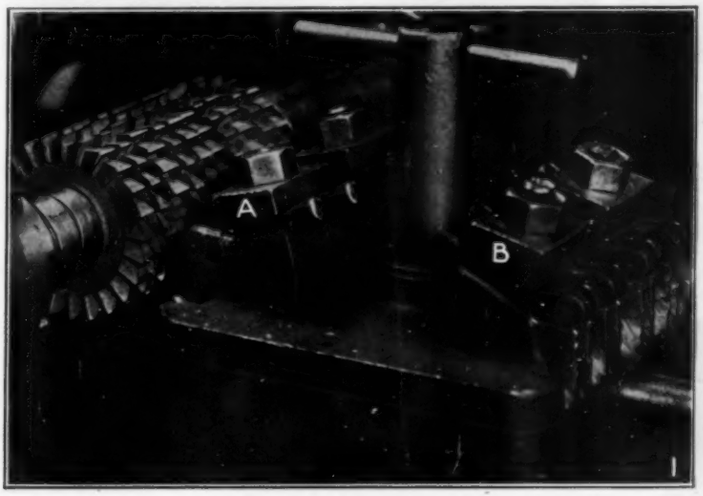


FIG. 1. MILLING BRAKE ROD CLEVIS.

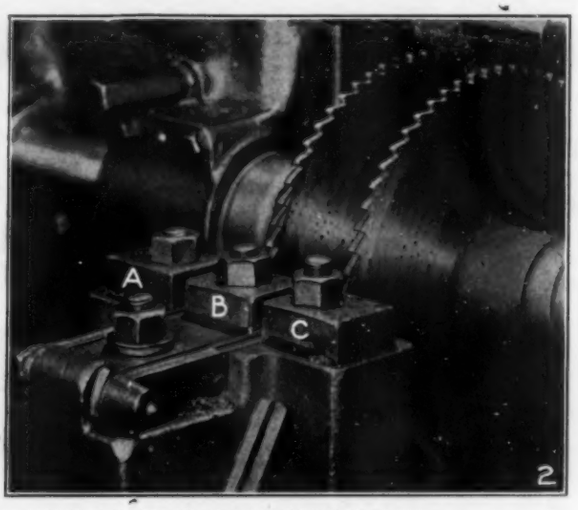
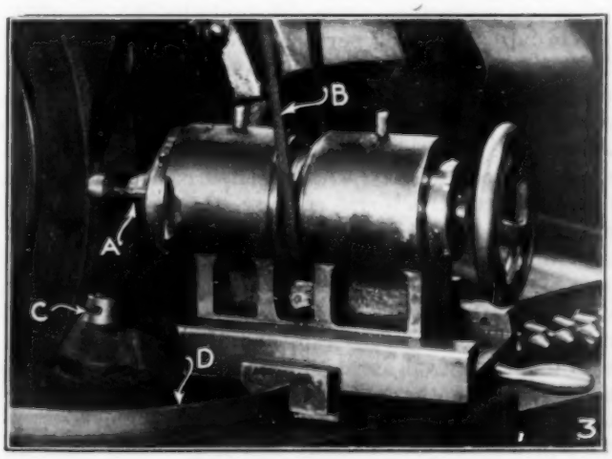


FIG. 2. SLOTTING PEDAL EXTENSION



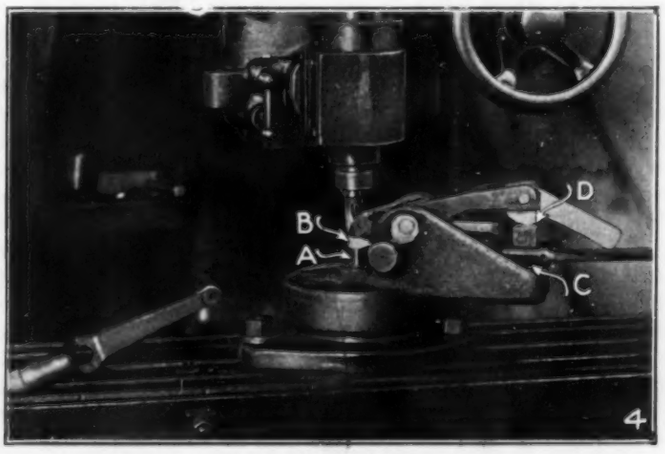
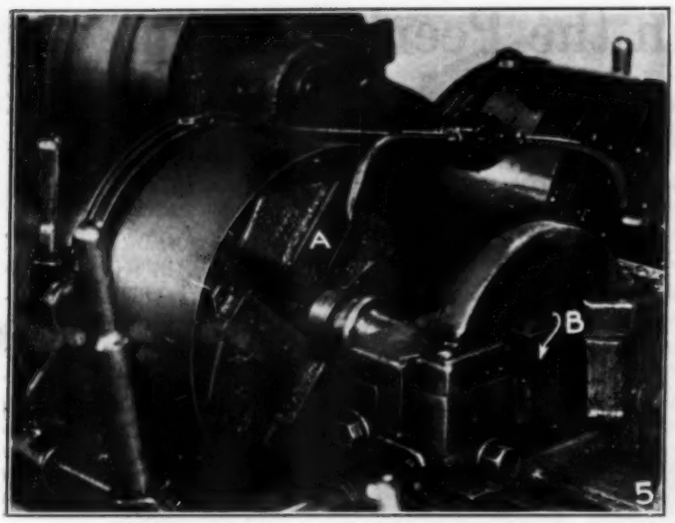


FIG. 3. GRINDING BALL END. FIG. 4. MILLING CHANGE GEAR LEVER



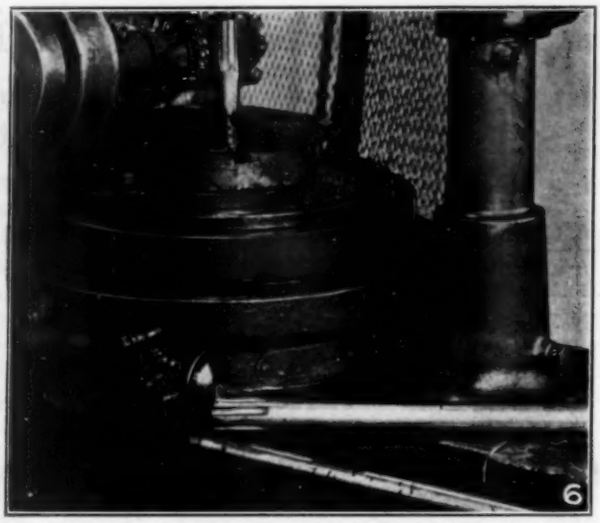


FIG. 5. THREADING REAR AXLE. FIG. 6. SPLINING REAR AXLE

pressure at both points of contact. The fixture is then swung around its center by means by the change gear lever itself.

Threading the two diameters on the rear axle is shown in Fig. 5. As shown in the illustration, the thread is being cut on the large diameter which is

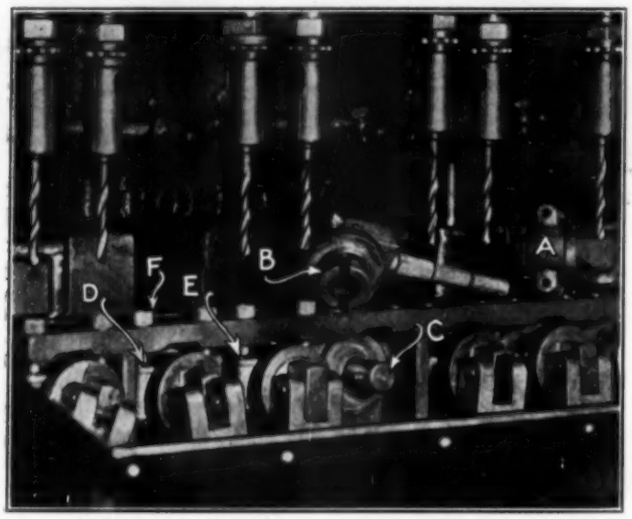


FIG. 7. DRILLING CONNECTING ROD BOLT HOLES

inside the wheel when in use on the car. This part of the axle is 2½ in. in diameter with 16 threads per inch. In this operation there is a support inside of the spindle of the machine to guide the axle while it is held at its outer end. The die head at *A* revolves around the axle. In threading the small end (which is ¾ in. with 14 threads per inch) for the nut that retains the wheel on the axle, the axle is reversed, the large end being held by the jaws at *B*.

The set-up for hobbing the splined end of the rear axle is shown in Fig. 6. Here one end of the axle is held in a hollow spindle while the other end is guided by a center on the inside of the machine. There are six splines 2 in. long at the full depth of the slot, the slot being hobbed in the usual manner.

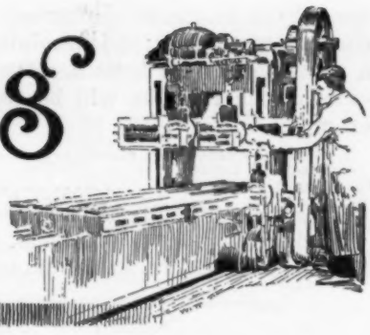
The method of drilling connecting-rod bolt holes is shown in Fig. 7. The rods are held in an unusual way but it is one that has much to commend it. The large end of the rod *A* is slipped over the holder *B*. The holder *B* carrying the rod is then slipped over the stud *C*. The slot in the holder fits over the pin shown in stud *C* and a partial turn locks the rod in place by means of the inclined slots in the holder. Rod bosses can be seen in place at *D* and *E*. The drill bushings which guide the drills during this operation are shown at *F*. It will be noted that there are twice as many fixtures as there are drilling spindles which enables one set of rods to be loaded while the drills are at work on the other set.

Aeronautics in Peacetime

In spite of the depressing conditions under which the aeronautical industry is laboring, the technical development of the flying machine is not by any means being neglected. On the contrary, experimental and research work of a bold and ambitious nature is being actively prosecuted in many quarters. Ideas are changing and advancing rapidly, almost if not actually as rapidly as they did in the war period. During hostilities the progress made was great outwardly but, in point of fact, it was very largely indeed composed of a refinement of detail, a growth in the absolute size of machines, and a development of the country's capacity to build them, their engines and accessories. Of genuine technical evolution, the war period showed much less than is ordinarily supposed. The airplanes at the end of it, with one or two exceptions, were substantially the machines of 1914 with increased performance and added powers. None of the belligerents could afford to spend much time in developing radically new and untried ideas. The progress effected was truly remarkable, but it was practically all made within the lines of the earliest machines to take the field. Today, with the leisure enforced by the dullness of constructional activity, the country's aeronautical designers and research workers are exploring fields that, although visible during the war, were by force of circumstances all but forbidden to them. The evolutionary tendencies in play at the present moment are powerful and widespread, and if the industry can be granted survival for a space, they will almost certainly result in the near future in practical developments, besides which the progress made during the war will assume considerably less importance than we have been accustomed to accord to it in the past.

Metal Cutting Tools.

By A.L.DeLeeuw



XVI. Thread Cutting Tools—Analysis of the Cutting of a Square Thread—Acme and V Threads—Single and Multiple Threading Tools—Thread Milling

THE cutting of threads is such a common operation in a machine shop that but few people realize how difficult it is to cut a thread theoretically correct. The great majority of threads cut do not require a high degree of accuracy and the ordinary methods in use in the machine shop are good enough to produce such threads. On the other hand, many pieces must be threaded in a way which will secure good fits, and when this is the case the methods and tools employed in thread cutting should be so chosen as to meet the requirements of a very complex problem. For this reason we should analyze the action of a thread cutting tool somewhat in detail, and we will start with the cutting of a square thread.

The square thread is the most difficult to produce correctly, because all the problems which one meets in cutting other kinds of threads are emphasized and magnified when a square thread must be cut. Fig. 255a shows a portion of a square thread already cut. The problem is to cut the gap somewhat wider and deeper. This problem is a very simple one. All one has to do is to cut out the left side of the gap with a left-hand side cutting tool, the right side with a right-hand side cutting tool, and the bottom with a square nosed tool. Fig. 255b shows the same piece in side view, and shows the left-hand tool in position. A point P travels in the direction of arrow No. 1, whereas the tool travels in the direction of arrow No. 2; the result being the same as if the point P traveled in the direction PQ while the

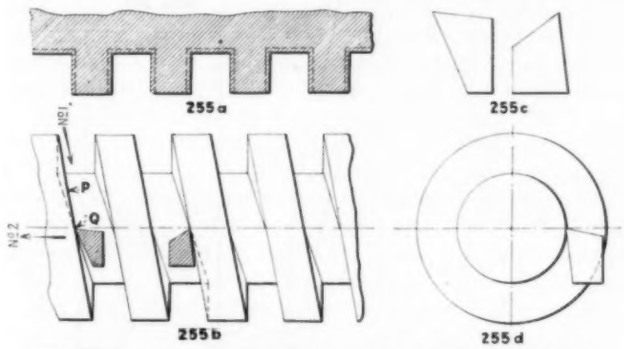


FIG. 255. SQUARE THREAD AND CUTTING TOOLS

tool is standing still, or what is the same again, as if the tool were traveling in the direction QP while the work is standing still. Under those conditions the tool as shown has the proper rake and clearance. In the same illustration the right-hand tool is also shown, and it will be noticed that both in regard to rake and clearance the right-hand tool has an entirely different shape from that of the left-hand tool. To bring this out somewhat stronger the two tools are shown side by side in Fig. 255c.

There is, of course, no difficulty in making these two tools the way they should be, nor is there any difficulty in making the square nosed tool as it should be and as it is shown in Fig. 255d. The difficulty lies in the fact that in ordinary practice these three tools are combined into one, and that it is not well possible to give the tool such a shape that its left-hand side, its right-hand side and its front side all have the proper shape and angles

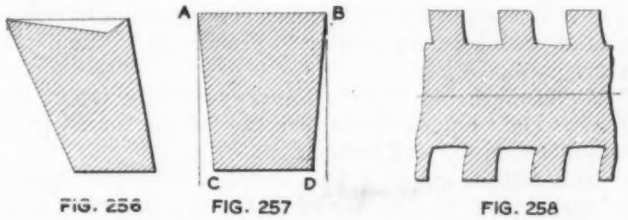


FIG. 256. THEORETICALLY CORRECT CUTTING TOOL. FIG. 257. TOOL FOR CUTTING SQUARE THREADS WITH SMALL LEAD. FIG. 258. WHAT HAPPENS WHEN TOOL IS SET AT AN ANGLE

for cutting in the correct manner. It would be possible to give the three cutting edges clearance, but it would be very difficult indeed to give all three edges rake. Fig. 256 shows what the cross-section of such a tool would be. It will be seen at once that it would be extremely difficult to make or maintain such a tool.

For square threads with small lead a tool is used such as shown in Fig. 257. For a right-hand thread there would be rake at the point A, negative rake at the point B, little clearance along AC and excessive clearance along ED; while the front edge AB would have neither positive nor negative rake. If a left-hand thread were to be cut there would be positive rake at B, negative rake at A, scant clearance along BD and excessive clearance along AC; whereas the line AB would be working under the same conditions as before. The difference in clearance of the two sides and the amount of negative rake at one edge remains small as long as the angle of the thread is small. But when the angle of the thread becomes of some magnitude the negative rake causes the thread to be torn on that side and unfit where smoothness and accuracy are required. A common method of overcoming this difficulty is to set the top of the tool at right angles to the spiral. Right here we meet our first difficulty, because there is, correctly speaking, no such thing as "the angle of the spiral" of a screw thread. As we go from the outside of the piece

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toward the bottom of the thread the angle of the spiral changes continually; it is a minimum at the outside and a maximum at the bottom. The difference in angle is quite considerable as will be seen from the following example:

Outside diameter of screw	2 in.
Pitch of thread	½ in.
Depth of thread	¼ in.

This makes the diameter of the core 1½ in. The outside circumference is 6.2832 in. and the inside circumference is 4.7124 in. The cotangent of the spiral angle

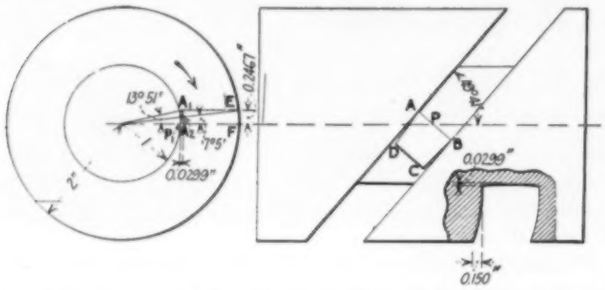


FIG. 259. SQUARE THREADED SCREW WITH STEEP LEAD

at the outside is $6.2832 \div \frac{1}{2} = 12.5664$; and the cotangent of the spiral angle at the inside is 9.4248 in., so that the angle at the outside of the thread is 4 deg. 30 min. and at the inside of the thread 6 deg. 10 min. The difference in angles becomes correspondingly larger as the pitch becomes greater in proportion to the diameter.

As a compromise it is customary to set the top of the tool at right angles to the direction of the thread halfway between top and bottom.

This method seems to be a simple way of getting out of trouble, but as a matter of fact it is a way of getting out of one trouble and into another one which may be quite serious if the screw has a very steep thread, such as in screws used for screw presses. The result of settting the tool at an angle with the axis of the work is that neither the right nor left side nor the bottom of the thread will be a straight line. If such a screw were cut along a plane going through the axis the appearance would be as shown in Fig. 258 in a somewhat exaggerated form. It may seem at first as though it would not be possible to make a thread with curved sides by using a tool with straight sides, but a little analysis will show this to be the case nevertheless.

In Fig. 259 are shown the elements of a screw with very steep lead. The outside diameter is supposed to be 4 in., the lead 8 in., double thread; so that the core diameter is 2 in. *ABCD* is a cross section of the tool of which the top is set at right angles to the direction of the thread. This causes point *A* to be above and point *B* below the center. The point *P* is supposed to be the center of the front edge of the tool. Looking at the end view of the screw we will find that *P* cuts at the point P_1, and that therefore *A* cuts to the point A_1.

The line *AB* was set at right angles to the slope of the thread at the pitch line. At this point the diameter is 3 in. From this diameter and the lead, which is 8 in., we find that the thread makes an angle of 49 deg. 41 min. with the axis. Allowing this angle and the length of the line *AP*, which is equal to one-fourth of the pitch times the cosine of 49 deg. 41 min., we find that the line A_1P_1 is 0.2467 in. With these elements we can calculate angle A_1OP_1 which we find to be 13 deg. 51 min. We can also calculate the angle *EOF* which we find to be 7 deg. 5 min.; so that angle A_1CE is 6 deg. 46 min.

In order that the screw thread which we are cutting shall be a square thread, all points which lie on the thread and also on a plane going through the axis must be in a straight line and at right-angles to the axis. The line *OE* represents the intersection of such a plane with the cross section of the screw. On the other hand, the line EA_1 represents a straight line, because it is the cutting edge of the tool; so that all points between *E* and A_1 lie on a straight line and at right-angles to the axis. The point A_1 travels in the direction of the arrow and when it has reached the point A_2 it should be so located that A_2E is a straight line and at right angles to the axis. In traveling from A_1 to A_2 the point A_1 has gone through an arc of 6 deg. 46 min. If this point had gone through an angle of 360 deg. it would have advanced a distance of 8 in. As it has gone through an angle of 6 deg. 46 min. it has advanced a distance of

$$\frac{6^\circ\ 46'}{360} \times 8 \text{ in.} = 0.150 \text{ in.}$$

The important point which we get out of the foregoing is that the cutting edge of the tool must be on the center in order to get a straight line outline of the thread in an axial plane. Though we took as example a square thread and one with a very large lead, the principle remains unaffected whatever the shape of the thread or the amount of the lead. The error may become quite small; in most cases so small that we can disregard it. But we must keep it in mind whenever we want accurate threads. For instance, we must either correct the shape of the milling cutter or else finish chase the thread of a screw made on the thread miller if we want a very accurate job, especially when we have to deal with a coarse lead. There is no objection to using the tool as indicated in Fig. 259 for roughing,

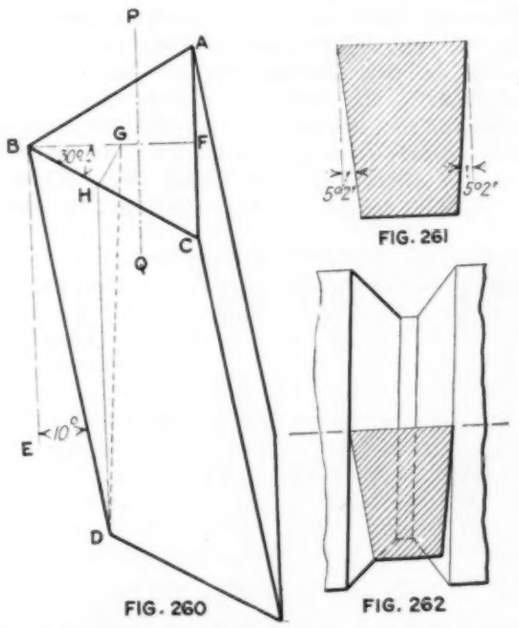


FIG. 260. THREAD CHASING TOOL. FIG. 261. SECTION ALONG PQ. FIG. 262. SECTION IN PLACE ON WORK TO SHOW CLEARANCE

provided we finish the sides and bottom of the thread individually. In many cases it is immaterial whether we have a fit at the bottom or not, or rather we should say, a fit at the bottom is not wanted. And in that event

it is not necessary to finish the bottom. The sides, however, should be finished. We may read in handbooks in regard to the cutting of square thread screws that it is good practice to make the gap between the threads in the nut a little larger than the thread of the screw, and very wisely it is not stated how much that little is. If both screw and nut are finished with the proper side

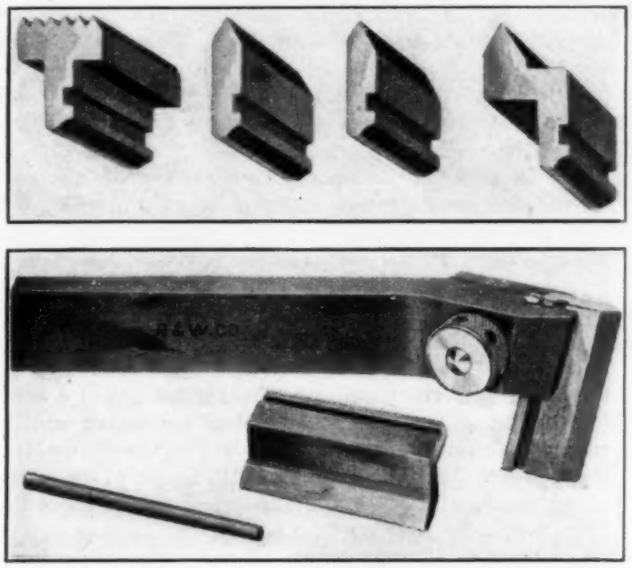


FIG. 263. THREADING TOOLS AND HOLDER OF PRATT & WHITNEY CO.

cutting tool there is no more need for clearance in square thread screws than in any other kind of screws.

The great majority of screw cutting produces screws with V-thread, that is, threads of which the section is a complete equilateral triangle or a part of one. Some threads, particularly those used in other countries, may be of a different cross-section, but they sufficiently resemble the threads used in this country so that the principles of thread cutting, which will be mentioned in the following paragraphs, apply equally well.

Threads are cut by three methods: (1) Chasing; (2) milling; (3) hobbing.

For the chasing of a thread a single-point tool is used, having the same cross-section, broadly speaking, as the cross-section of the gap between the threads. The chasing tool is therefore a form tool, and all remarks we have made about form tools for screw-machine work apply here. The tool should be so constructed that it can be ground on the face and will preserve its contour.

In Fig. 260 *ABC* is the top of the chasing tool and is made in the form of an equilateral triangle. The tool is set at an angle with the vertical line. This angle serves the purpose of giving clearance to all points of the tool; the greater the angle *DBE*, the greater the amount of clearance. However, there is a limit beyond which one cannot go without weakening the front part of the tool. Suppose the angle *DBE* were 10 deg., then the two angles of clearance at the points *C* and *A* would be different from 10 deg. In order to find what this clearance angle is we will drop the perpendicular *EF* on the base of the triangle. If we now draw the line *DG* at right angles to *BF* we will have an angle *BDG* which is also 10 deg. If we should make the line *BD* equal to *one*, then *BG* would be equal to sine 10 deg. = 0.17365 in. We would obtain the angle of clearance of a point along the line *BC* by drawing a perpendicular from *G* to *BC*. The angle *GDH* will be the angle of clearance.

As $BG = 0.17365$ in. and $\angle GBH = 30$ deg. GH will be one-half of 0.17365 in. = 0.08682 in. As $BD = 1$, $GD = \cos 10$ deg. = 0.98481, $\tan HGB = \frac{HG}{DG} = \frac{0.08682}{0.98481} = 0.08816$; so that $\angle GHD = 5$ deg. 2 min.

This calculation was carried out here because the same method applies if any other shape of tool is used. A simpler method may be followed when the angle of the tool, that is the angle of the thread to be cut, is 60 deg., as it was in our example. In that case, assuming the clearance angle at the point to be α we have:

$$GB = BD \sin \alpha,\ GH = \tfrac{1}{2} BD \sin \alpha,\ GD = BD \cos \alpha$$

$$\tan GHD = \frac{GH}{GD} = \frac{\frac{1}{2} BD \sin \alpha}{BD \cos \alpha} = \tfrac{1}{2} \tan \alpha$$

so that we see that for a 60-deg. tool the tangent of the clearance angle at all the points equals one-half the tangent at the apex.

If the point of the tool is cut off so as to make it flat at the root the clearance at the flat will be the same as the clearance at the point. The clearance angles we have found here would be the true clearance angles if the tool were used to cut a groove around a cylindrical piece; but they are not the clearance angles between tool and work when a spiral groove must be made. If we should take an infinitesimally thin slice along the line *PQ* and going vertically down the tool, we would obtain such a piece as is shown in Fig. 261. If we had also cut part of the thread away, along the same line, we would find this slice resting against the thread as shown in Fig. 262, and it will clearly be seen that the true clearance angles at the points *A* and *B* are the clearance angles of the tool plus or minus the spiral angle of the thread. This spiral angle is a maximum at the root of the thread and that is the point where we will have to work with the minimum clearance.

Taking for example a 1-in. bolt which has eight threads to the inch and of which the root diameter is

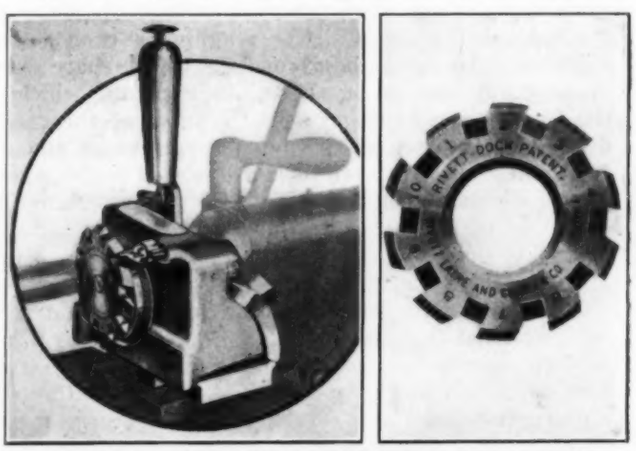


FIG. 264. RIVETT-DOCK FORMED CUTTER TYPE OF THREADING TOOL

0.838 in., the angle of spiral will be 2 deg. 43 min. at the root; so that the actual angle of clearance on one side will be 5 deg. 2 min. — 2 deg. 43 min. = 2 deg. 19 min., which is too small for a proper cut. It would therefore be necessary to increase the clearance angle at the point, and this means a weak and delicate tool. Here we have the first difficulty we meet in trying to cut a V-thread.

Fig. 263 shows a tool and toolholder for cutting V-thread, as made by the Pratt & Whitney Co. The holder assures the setting of the tool in the proper way in relation to the holder. The tool is made so that when it is set on center and with the top of the tool horizontal, it will do its work as it is intended to do.

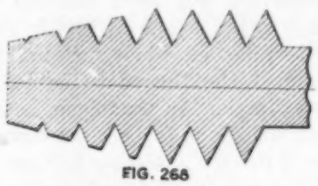


FIG. 268

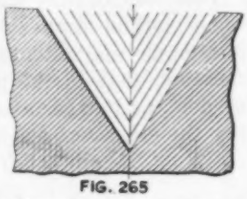


FIG. 265

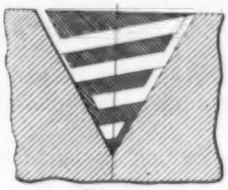


FIG. 267

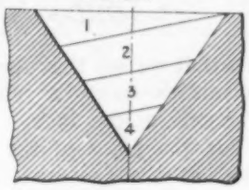


FIG. 266

FIG. 265. SUCCESSIVE CUTS BY SINGLE POINT TOOL.

FIG. 266. SUCCESSIVE CUTS BY TAP. FIG. 267. EFFECT OF IMPERFECT TAP. FIG. 268. CONSTRUCTION OF ORDINARY TAP

As the front edge of the tool is set to an angle of 15 deg. with the vertical, it was necessary to make the contained angle of the tool slightly different from 60 deg., so that the horizontal section is 60 deg. The tool should be ground on the top surface only, and this ground surface should be at an angle of 75 deg. to the front edge.

In chasing a thread a cut is taken the length of the thread, the cross-slide is pulled out, the carriage returned, and then the cross-slide is set forward a certain amount beyond its original position, in order to take a second cut. This process is repeated until the proper depth of thread is reached. It requires considerable skill to divide the cut evenly and always to have the same depth of cut when the work is finished. Besides, the same tool is doing all the roughing as well as the finishing. To meet these conditions tools have been brought out such as illustrated in Fig. 264, which is the Rivett thread cutting tool. In this tool the cut is divided up into ten cuts, leaving a very small amount for the last cut. The ten tools are part of a disk where each individual tool is treated like a formed milling cutter so that it can be ground on the face and still retain its shape.

The great majority of threaded parts are not cut with a single-point tool. Internal threads are cut with taps, external threads with dies. Taps and dies are a modern development of the oldest method of cutting threads, which was by means of a chaser. Before the modern lathe had been developed, there were no means of assuring a proper lead of a screw except the skill of the workman. Where threads of some slight degree of accuracy were required, such skill could not be relied on, and the workman would make himself a tool which would insure the proper lead. Such a tool was the chaser. It is nothing but a number of single-point tools set side by side and the proper distance apart.

Fig. 263 shows such a chaser, though not exactly in the form it was used on hand lathes. If this chaser is to cut a thread from right to left, then the left-hand cutting point is the one active part of the tool. The workman would try to move the tool toward the left so that one lead would be generated with one revolution of the work. If he missed it more or less, he could correct it the moment the second part of the tool would strike the work, and correct it still further with the third and fourth tool. As he went over the work a second time he would start with practically no cutting pressure, guiding the first section of the tool in the previous cut and waiting until the second section struck the work before he forced the tool in deeper. In this manner he would proceed until he had reached the full depth of the thread to be cut. The chaser, then, was a cutting tool and also a guide which permitted him with a relatively small amount of skill to produce a thread with a reasonably high degree of accuracy. As chasers are used now there is no skill of the workman needed to manipulate them or to correct an error made in the previous cut. Besides, chasers nowadays as a rule cut a complete thread in one pass, or at the most, two passes, so that, no correction is possible.

A tap is in all respects a chaser. In other words, it is a thread-cutting tool combined with a device for assuring the correct lead. A tap is made out of a screw by cutting grooves in it and thus producing cutting edges. If nothing else were done to the screw then there would be only a single cutting point in a tap. If we make a tap with four gashes it might seem that there would be four cutting points, but such is not the case; because all four points of one convolution follow the groove cut by the first point, and as this first point could not have proceeded in the groove unless it had provided sufficient clearance for itself, it follows that there is no metal left in that groove which the succeeding point must cut away. For that reason the entering part of the tap is made conical. This brings every succeeding cutting point to a somewhat larger diameter, and in this manner each point will do part of the cutting. However, these succeeding cuts do not resemble the cuts taken with a single-point chasing tool. With such a tool each cut is of V shape.

Fig. 265 shows how a cut is taken with a single-point tool. The groove made is at all times a V-groove, becoming a deeper and wider V with each successive cut. Fig. 266 shows the nature of the succeeding cuts taken by the various cutting points of a tap. It will be seen that every cutting point finishes part of the completed thread. If the various cutting points of a tap should not lie on a perfect spiral, it might be that some of these cutting points will cut more or less to the right or left, producing a result as shown in Fig. 267. Such a condition would cause a rough thread, besides making the groove too wide. As every cutting point finishes part of the thread it follows that no matter where dulling occurs the tap will stop functioning properly as soon as any point is dull.

Fig. 268 shows the construction of the ordinary tap in much exaggerated form. The portion beyond the taper simply serves as lead screw.

A tap as shown in Fig. 268 can be used where a tapped hole must go through the entire thickness of the metal, or where it is not necessary that the full thread shall be generated the entire depth of the hole. But where a thread is required all or nearly all of the full depth of a blind hole, such a tap would not produce the proper results. In that case, more than one tap must be used. The second tap will have a shorter taper and perhaps a somewhat larger diameter, the third tap a still larger diameter and practically no taper at all.

(Continued in next week's issue.)

A Portable Power Saw for Big Timber—Boring and Grinding Motor Cylinders in a Milling Machine—A Pair of Unique Brass Furnaces

THE cutting and handling of big timber has developed many mechanical devices which are unknown in the Eastern woods. This is because of the different problems presented in handling timber from one to two feet in diameter, or having it run from four to ten feet in diameter and of proportionate length. While the actual felling of trees differs very little in the various sections of the country, the method of handling them after they are on the ground has been developed in an interesting manner. One of these devices is known as the drag-saw, which takes the place of the old two-man cross-cut saw and eliminates hours of hard work as well as the accompanying backaches.

The drag-saws illustrated herewith are manufactured by the Beaver State Motor Co. in the little town of Gresham, Oregon, just outside of Portland. The modern and attractive plant is shown in the headpiece. The drag-saw itself is shown in Figs. 1 and 2 and as can be seen is a very simple little device which does almost unbelievable work on logs up to 10 ft. in diameter. The logs shown are approximately 5 ft., the sawing time for a 4-ft. log being 4 min. and for a 5-ft. log, 7 minutes.

As can be seen, from the illustrations, the machine itself consists of a small gasoline motor, mounted between a pair of substantial skids, the motor driving a large sprocket by an extra heavy 1-in. Whitney roller chain, this giving the cross-cut saw a stroke of about 2 ft. The arrangement of the fuel tank and the water tank is clearly shown. The whole machine can be easily carried by two men and can be moved along the log by a single operator. Two steel dogs at the upper end of the skid are driven into the log and hold the whole thing firmly in place.

Boring and Grinding Cylinders

The shop itself is interesting, as well as the methods used in building the motor. One of the features of the motor is that the force of the explosion is taken on a solid bearing, in place of the usual construction where the cap is bolted in place. The machining operations are not unusual, the quantity not being sufficient to install special machinery for the different operations.

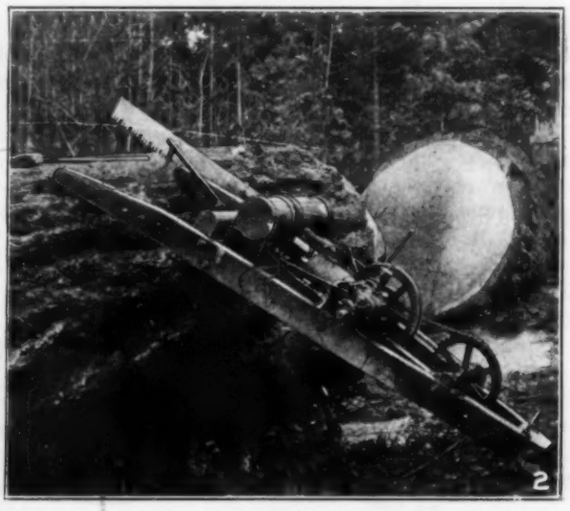


FIG. 1. DRAW SAW AT WORK. FIG. 2. SEEN FROM THE OTHER SIDE

The cylinder is bored on a knee type milling machine using the fixture shown in Fig. 3, which bolts the cylinder firmly in place and is easily located on the milling machine table by means of a suitable tongue on its base. After the cylinder is bored the whole thing, cylinder

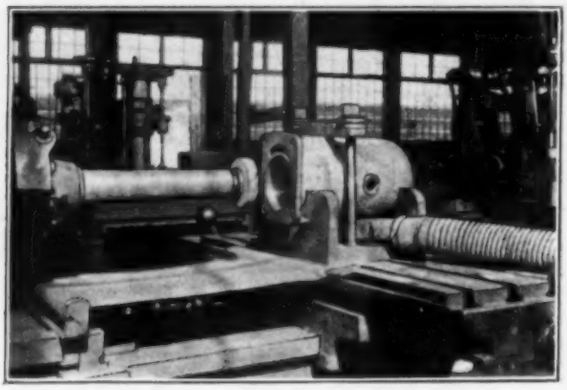


FIG. 3. GRINDING CYLINDERS

and fixture together, is removed to the milling machine, shown in Fig. 3, and similarly mounted on its table.

The spindle of the machine carries the special grinding head shown, this being given a rotating motion by means of the regular spindle of the machine, while at the same time the grinding spindle is driven at its proper speed from an independent source. Grinding devices of this kind are also used in automobile repair

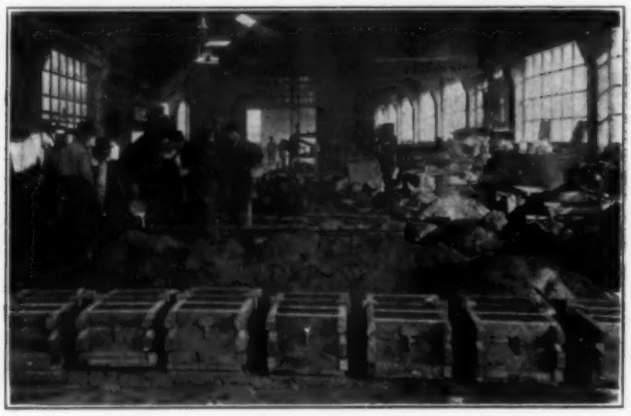


FIG. 4. THE IRON FOUNDRY

shops, the interesting feature of this operation being the changing of the fixture and cylinder from the boring operation to that of grinding.

The smaller building at the right of the headpiece is the foundry, of which an interior view is shown in Fig. 4. Here are made all the iron castings for the shop. Through the open door is the brass foundry which

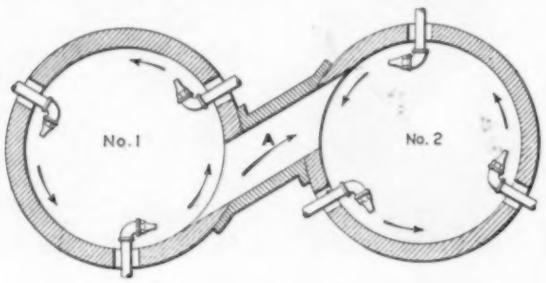


FIG. 6. HOW THE FURNACES WORK

contains a pair of interesting furnaces, designed by the president, P. A. Combs, and built in the plant.

An idea as to the construction of the furnaces can be had from Fig. 5, showing them sunk into the ground near the outer wall. Gas is used for fuel, the piping

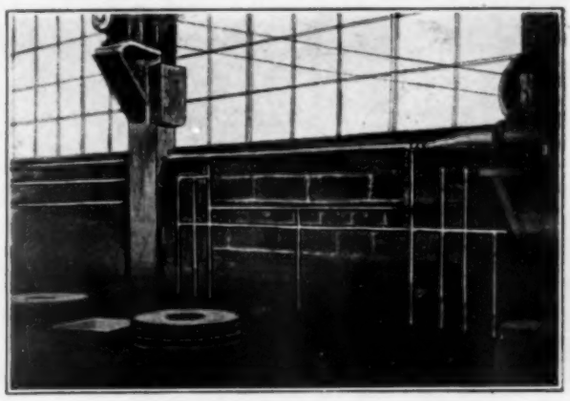


FIG. 5. THE BRASS FURNACE

being shown against the wall. The design of the furnaces, however, is very unique, as can be seen from the plan view in Fig. 6. The furnaces are circular and hold crucibles containing 180 lb. of brass and use a pressure of 4 oz. of air in connection with city gas. The furnaces heat up in from one and a half to two hours and after that will melt 180 lb. of metal in 30 minutes. It will be noticed that the furnaces are so set that the gas

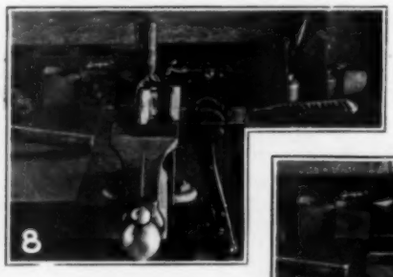


FIG. 8. COMPLETED BEARING

FIG. 7. MOLD FOR BEARINGS

jets give a rotary motion to the flame, and that there is a tangential passage *A*, between furnaces Nos. 1 and 2.

The plan is to use furnace No. 2 for pre-heating a second crucible of metal, utilizing the heat which escapes from furnace No. 1. However, gas is not turned on to No. 2 until the crucible in No. 1 has been removed for pouring. As soon as the crucible has been removed from No. 1, the gas is turned on in No. 2 and shut off in No. 1. A new pot of metal is then placed in No. 1 which becomes the pre-heating furnace, receiving heat from No. 2 in addition to utilizing that already stored in the fire brick of its walls. By using this method it is possible to melt 360 lb. of brass with 12,000 cu.ft. of gas, which at 45 cents per thousand, makes very cheap fuel. This same furnace has been used to melt steel but in that case an air pressure of 16 oz. was found desirable and 16,000 cu.ft. of gas was necessary.

An unusual casting process is shown in Figs. 7 and 8 in which bearings for a special machine are cast in a very convenient mold.

Deflecting a 4½-inch Bar With a Visiting Card

Measuring the Amount of Deflection by Bands of Light—How and Why the Bands Are Used—Making the Apparatus

By RUSSELL W. PORTER, M.S.
Jones & Lawson Machine Co.

ONE of the spectacular, if not directly useful, applications of light in the machine shop is that of the deflection bar. To actually see the bending effect on a massive bar of steel by a slight pressure of the finger, and to know conclusively that one is measuring with considerable accuracy so small a quantity as one millionth of an inch—or less—is, to say the least, sensational. It is only the knowledge that an extremely minute flexture has been observed, that prevents the experiment becoming somewhat disquieting.

The device is not difficult to make; any mechanic with a little care and patience can put one together. The purpose of this article is to describe a simple form of the deflection bar, and to explain from the undulatory theory of light, how the instrument functions.

As seen in Fig. 1, the apparatus consists of the bar itself, a solid cylinder of steel 4½ in. in diameter by 20 in. long, supported at its two ends, and having a suitable support for holding the optical elements fastened to it by means of studs. The support in the instrument illustrated is an angle iron: a channel iron would do as well. To the under side of the angle iron is fastened (see Fig. 2) one of two bars of ordinary commercial plate glass. The other and lower bar of glass is held against the upper bar by the adjustable thumbscrew *B*. The adjacent glass surfaces are not in actual contact but are separated by a thin strip of tinfoil at *A*. *C* is a hole bored in the angle iron directly over the glass bars near the end.

Deflection Shown by Light Bands

In using the device with a suitable light source, one looks down through the hole *C* at the glass, when, by turning screw *B* until the plates are approximately parallel, one will see alternating light and dark bands crossing the glass, like the teeth of a fine tooth comb. These bands are due to interference between light reflected to the eye from the two glass surfaces nearly parallel to each other and nearly in contact. If a slight downward pressure is now brought to bear upon the steel bar, these bands will move to the left. If the finger is placed under the bar with an upward pressure, the bands are displaced in the opposite direction—to the right. By pressing on the extremities of the bar, top or bottom, the mass of steel may be made to buckle down or up, and the bands will move in the directions expected.

The explanation of these interference bands rests on the generally accepted undulatory theory of light. If attention is given to Fig. 3 where for clearness the departure from parallelism of the glass bars is exaggerated, and considering only the two glass surfaces in near contact, it will be seen that part of ray *A* is reflected to the eye from the upper surface *C*, and part from *D*. Of these two reflected rays (*a* and *b*) *b* must have traveled a little farther than *a*, since it was obliged to traverse the air space *E* twice. If this increased path retarded *b* by a half wave length, the two beams would be out of step as it were, from crest to trough, and they would destroy each other. In other words, there would be extinction here and we would see a dark band. With ray *B*, however, the increase of path *b* is enough to permit its gaining a whole wave length over *a*, when it emerges in step with its partner, crest to crest, trough to trough, and the amplitude is doubled. There would be intensification here and we would see a bright band.

These interference bands can best be seen by using a one color light. The easiest way of producing such a light source is to burn sodium chloride (common table salt) in the flame of an alcohol lamp. Mount the lamp as in Fig. 4 and fix a piece of asbestos saturated in brine in the lamp flame by means of a twisted wire. The light of the mercury vapor, or Cooper-Hewitt lamp is also very satisfactory.

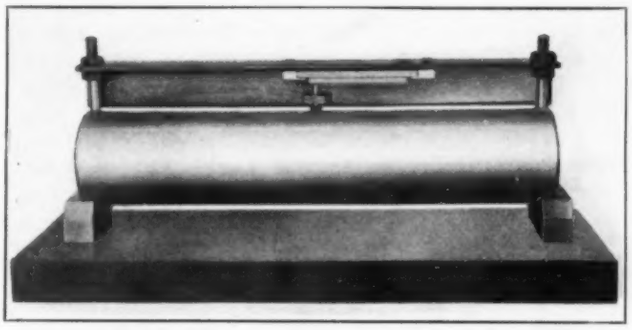


FIG. 1. A SIMPLE DEFLECTION BAR

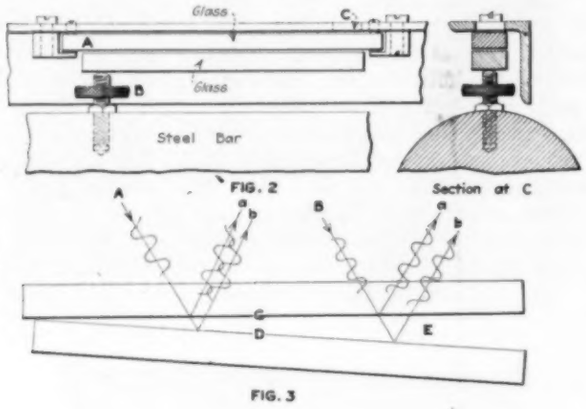
A wave length of sodium light is approximately one fifty thousandth of an inch. It follows, therefore, that the difference in the thickness of the air film, measured from band to band, will be about one hundred thousandth of an inch.* By using a little care in adjusting the glass, these bands may be broadened or narrowed at will. As they broaden out, the surfaces are becoming nearer parallel; as they crowd together the angle of the wedge of air is increasing. In this respect the bands may be interpreted very much as contour lines on a map. And so, if the bands move sideways a distance equal to the width of one band, there is only one possible deduction—the lower glass has dropped away 1/100,000 in. This is not quite exact, due to the fact that we are looking at the glass at an angle, and not straight down upon it. For the complete formula, see the *American Machinist*, Vol. 53, page 631. If the leverage, due to the setscrew being near the left end of the glass bar, is say 10, then the steel bar itself has bent ⅒ of 1/100,000 or 1/1,000,000 in. By using broad bands, one-tenth of this displacement may be easily observed. I have detected an appreciable flexture to the 4½-in. bar 18 in. long in Fig. 1, by applying a pressure to the middle of the bar with a visiting card held on edge.

Applying 1 lb. weight on the middle of this bar, the amount of the shift of the bands, taking into account the

*See Wood's "Physical Optics" (McMillan & Co., N. Y.), pp. 155 and 159.

leverage of the lower glass bar, called for an approximate bending of the steel bar of 0.00000025 in. This was checked by deriving the theoretical flexture from the modulus of elasticity of structural steel. The result was 0.00000027 in., in good concordance with the value derived from light interference.

A few cautions are to be observed should any one attempt one of these extremely sensitive pieces of



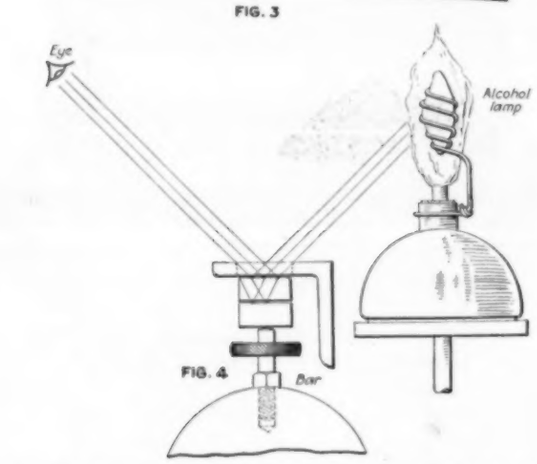


FIG. 2. HOW THE TWO GLASS PLATES ARE HELD. FIG. 3. HOW LIGHT INTERFERENCE BANDS ARE PRODUCED BETWEEN TWO GLASS SURFACES IN NEAR CONTACT.

FIG. 4. THE DIRECTION THE MONOCHROMATIC LIGHT TAKES FROM THE ALCOHOL LAMP TO THE EYE

mechanism. Adjusting screw *B* should have a fine pitch thread and fit well in its tapped hole. The opposing glass faces must be kept free of lint and dirt. The glass to be used should be at least ¼ in. thick. Pieces of a broken windshield or mirror are serviceable. Lay one piece of glass on the other and observe the interference bands under the sodium flame, and select a region giving the straightest and at the same time broadest bands. After cutting out the bars, their edges may be smoothed up by grinding on any flat glass or metal surface, using as an abrasive either emery or carborundum with water.

Getting More Out of Labor

BY J. E. BULLARD

Payrolls have gone steadily up, or at least the wage rate has, but production on the whole has gone down. The great question today is how to get more out of labor. There are as many answers to this question as there are employers. But none of the answers seems to be entirely correct. One man says shut down the plant until the men beg for work. Another says adopt some profit-sharing method. Some other man believes in scientific management, while still another thinks that giving the men a share in the management will solve the problem.

Talk with the men and get their point of view and we hear something like this: "Why should we produce all we can? These times aren't going to last forever and the more we produce the sooner we'll be out of work." Profit-sharing methods are often looked upon with suspicion. It is not an easy matter to convince a wage earner that scientific management is not just a scheme to drive the worker faster, get more out of him without paying him in proportion and discarding him as soon as he is worked out. Giving the men a share in management may work and it may not.

It is evident that there is no panacea. Each and every plan suggested has defects of its own. It may prove a success and again it may prove an absolute failure. There is always danger that only one side of the question will be considered or at least that too great an importance will be given to one side. In the past the labor question has not been of such vital importance. If a man didn't prove satisfactory it was an easy matter to fire him and replace him with someone else. The supply on the whole was as great or greater than the demand. People were continually flocking here from Europe, they were willing to work and in many cases at lower wages than men already on the job. From 1820 to 1919, 33,200,000 aliens entered this country, a number equal to about 22 per cent of our total population.

SHORTAGE IN LABOR RANKS

The war, however, has changed all this. Our last census shows this to be the case. There are not so many people in the United States today as everyone thought there were before the census returns came in. There is scarcely a city that does not show a smaller population than it had thought it contained. The war did it. In every European country there was a great loss of life. A good part of this loss was confined to the laboring classes. A great many of our foreign born returned to their native countries during the war to join the colors. A great many more have returned since the end of the war to search for their friends and relatives. As a result it is estimated that the United States is now 4,000,000 men short.

Conditions in all the foreign countries are not such as to hold very great promise for the future. Labor conditions are more different there than they were before the war. The recent troubles in Italy show that fact very clearly. No longer is there promise that the United States will continue to be able to hold out the advantages in wages and labor conditions that it has in the past.

It seems to be a case of studying conditions and making the best of them. Shutting down the plant and waiting till the men beg for work will not solve the problem permanently. The time will come when it is necessary to start it up again. The same old fight will then be on. Neither the manufacturer nor the wage earner can afford to have the plant idle for any great length of time. In fact, with the present labor supply the wage earner may have the advantage. The man who owns the machinery and the plant can't afford to allow his investment to lie idle and he can't make it produce without labor but the laborer may be able to find something else to do. All the other methods also have their

defects. In all cases the trouble lies in the fact that all factors are not considered. To a greater or less extent each system is something of a fad.

When high-speed tools were first introduced into the machine shop they were not always an unqualified success. They did not increase production to the extent that they were expected to increase it. They did not lower the cost to the extent that it was hoped they would. This was due to the fact that the new tools were used on old machines. The lathe or drill press designed for carbon-steel tools was not sturdy enough to stand up under the heavier cuts and greater speeds suitable to tungsten steel. It became necessary to redesign the whole machine. Today with new machines designed for the purpose, the new tool steels meet all expectations.

In much the same way a great many ideas put forth and adopted for increasing production fail of their purpose for the reason that they are tools that are all right in themselves but for which the organization is not adapted. We need a little more data on the actual reaction of labor, on the mental attitude of labor. Sufficient progress in production cannot be made until the man himself is studied.

It would have been a great mistake to have condemned high-speed tool steel simply because the old style machines were not adapted to its use. It is likewise unwise to condemn any system of securing better results from labor because the organization in the plant is not adapted to the new system.

To a very great extent failure in the working out of some new plan is due to overlooking some factor that has a vital bearing upon the success of that plan just as many a machine shop in the early days failed to give sufficient consideration to the fact that its machines were not strong enough for these tools. However, it is not a difficult matter to solve the labor problem if it is gone about in an intelligent and scientific manner. In the field of both electricity and mechanics much more difficult problems have been solved during the past thirty years. It is just a matter of getting at the actual facts and not being satisfied with mere opinion.

The scientist in the laboratory when carrying on experiments keeps the most detailed records of all that takes place and the conditions under which the experiments have been performed. If he did not do this he would never be able to duplicate them in such a way as to secure again a result that he has once found to be desirable. Every shop and factory is a laboratory in which labor may be studied. In some very desirable results have been secured but in nearly every case not sufficiently detailed records have been kept to make it possible to duplicate these results in another shop or factory. As a result the plan may be condemned. If a detailed record had been made of all the conditions and causes that led to the final results there would be no more difficulty in getting the same results from the same plan in two different plants than there is in duplicating parts in different factories. To duplicate parts it is necessary to have the metal of the same composition and the jigs and the gages the same. Should there happen to be any great degree of difference between the expansion of the metal used and the gages, it may be necessary to keep the temperatures the same.

Some of the things that have a direct influence upon the results secured from labor are temperature and humidity of the room in which the men or women work, lighting, cleanliness, purity of the air, safety precautions, facilities for securing good meals, attitude of the foremen, superintendents and men higher up, the continuity of work and the like. Far too often these, or at least some of them, are overlooked. A firm that is steadily growing and has a continuous market for its product constantly adds to its force. It never lays men off because there is lack of work. This firm may adopt some system that secures excellent results from labor. Some other firm with a seasonable demand adopts this system and finds it very disappointing. In fact, it may make matters worse instead of better. The reason is simple. The conditions are so different that the system could not be expected to work.

If a system really works well in one plant and is transferred to another, every condition of the first plant being conformed to, even to the point of view of the man at the top, the plan will have to work just as well in the second plant as in the first. It can't help doing so. Change a few of the conditions, however, and the chances of making it a success are about as great as fitting Packard parts into a Ford car. The results are sure to be rather disappointing. What is needed more than anything else today is a gathering together of more facts and a reduction of the propaganda on the part of both employers and employees. Until we actually get these facts we can't hope to make much progress in permanently bettering conditions.

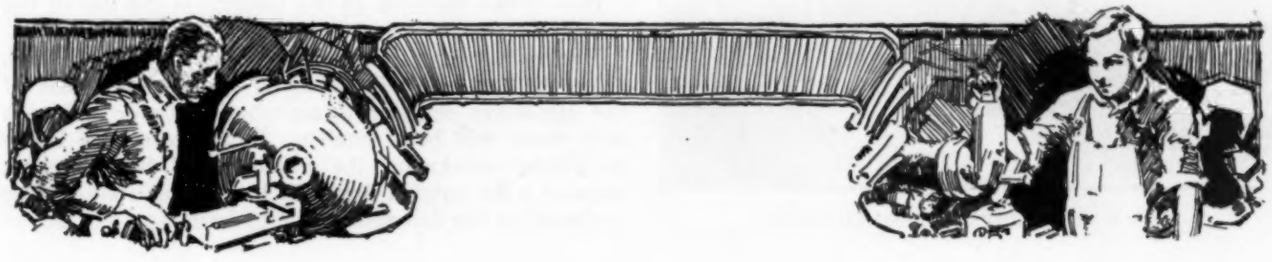
The Fokker Commercial 'Plane

The first of the Fokker F-3 monoplanes, which has been christened the "Half Moon," after the tiny Dutch ship in which Hendrick Hudson came to this country and sailed up the Hudson River in the year 1609, has now carried over 700 passengers since its appearance at Hazelhurst Field on July 21.

Very successful demonstrations, during which hundreds of people were introduced to the delights of a real commercial aeroplane as a means of travel, were held at Washington, D. C., Hartford, Conn., and Camp Vail, New Jersey. Bert Acosta piloted the machine.

From the point of view of economical transportation, the Fokker machine is believed to have made a record, gasoline consumption during all this flying working out at an average of 8 gallons per hour.

The Netherlands Aircraft Manufacturing Co. believe that by interesting the public in aviation in this way and showing what modern commercial planes can do, they will pave the way for the establishment of air transportation as a recognized means of traffic in this country, as it already is in Europe.



A Substantial and Convenient Tool Storage Rack

Taking Care of Shop Tools and Heavy Fixtures—A Strong and Permanent Structure Built by the Men in the Shop—Keeping a Record of Tools Issued

SPECIAL CORRESPONDENCE

IN COMMON with many other shops, the end of the boom period found the Lodge & Shipley Machine Tool Co., Cincinnati, O., with an urgent need for tool storage facilities. Unlike some of the other shops, however, it did not put off the building of the racks but considered it as part of its preparation for the return of good business. After securing estimates which seemed abnormally high, it was finally decided to design and build a rack from standard shapes, and the results have been most gratifying both as to usefulness and cost.

FIG. 1. STORAGE RACK FOR TOOLS

As can be seen from the data on the different plans, very substantial angles and plates are used, the angles including 1¼ x 2 and 2½ x 3½ in. with ¼-in. metal, and there are channels and tees, as well as substantial plates, all of which go to make up a construction which will hold any ordinary load, and is not only convenient but presents an attractive appearance. It is quite probable that somewhat lighter material might have been used, but as it was desired to have this a substantial and permanent institution, it was decided to take no chances. The general appearance of the construction is shown in Fig. 1, which shows how the racks reach up to the beams in the side bay of the shop, and also how fixtures are stored on a projecting platform so that they may be easily picked up by the crane which travels in the central bay. A closer view of one of the racks is shown in Fig. 2, this view showing the counter over which the tools are given out. As can be seen, there is a large counter space so that a number of men may be served at the same time and avoid delay. The illustration gives something of an idea of the appearance of the racks after completion and also shows the drill gage at *A* by which the drills in the sections at *B* may be sorted, or the size verified without delay.

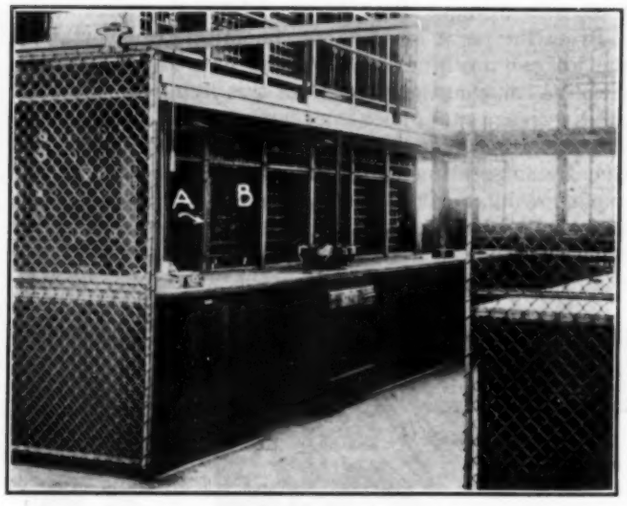


FIG. 2. THE DISTRIBUTING COUNTER

The general construction drawing, Fig. 3, shows the platform for heavy fixtures, which has already been referred to, at *A* and the stairs at *B* for reaching the upper section of the rack. These stairs are half hidden by the column *C* and are in reality of ample width, as can be seen in Fig. 1. In Fig. 3 is also shown the arrangement of shelves and pigeon holes, the dimensions of the latter being about 6 in. square.

A plan view of the tool storage department is shown in Fig. 4 and an elevation in Fig. 5, showing the shelf arrangement of the nine racks, the counters with their shelving and the platform above, which is reached by the stairway shown in previous illustrations. Figs. 4 and 5 give an excellent idea of the large storage capacity which has been secured, the total floor space occupied being approximately 30 x 70 ft.

Details of one of the racks are shown in Fig. 6, together with the kind and amount of material required. The total height is 14 ft. divided into two stories 7 ft. and 6 ft. 7 in. respectively. The racks are 3 ft. deep.

One of the features of the toolcrib is the use of the McCaskey register, located near the tool counter.

The names of all persons or firms borrowing tools from the tool-crib will be listed on the index leaf of the McCaskey register in alphabetical order and with each name will be a number. In the case of a Lodge & Shipley workman, the number will be his check number. An outside firm will have a register number assigned by the foreman of the toolcrib.

Each number has a space alloted to it in the register, the number being fastened to the spring clip, which holds the slips in place. The spaces are arranged in numerical order.

When tools are issued at the toolcrib, a tool register slip is made out in triplicate, one being shown in Fig. 7. These slips are used as follows:

When a tool is issued to a workman the original copy (pink) is given to the one to whom the tool is issued, the first carbon copy (yellow) is put in the register and the record carbon copy (manila card) is sent to the tool control desk for use in maintaining the tool inventory. When the tools are returned to the toolcrib, the first carbon (yellow) is taken from the register and sent to the tool control desk where it is used in maintaining the tool inventory; then it is destroyed. In order that the tool register slips may be of maximum use it is most important that the spaces calling for man's number, shop number, piece number, date, machine number and operation number be filled in as completely and clearly as possible.

When tools are issued for use outside the shop it is the duty of the toolcrib foreman to see that they are properly charged out and have them delivered to the purchasing department which takes care of delivering them to the person or firm to whom they are issued.

It is the duty of the toolcrib foreman to look through the register at least once a week to find out which slips are two weeks or more old, and to check the tools to see that they are not lost or broken.

When a slip is checked up a record should be made on the slip: (1) Of the fact that it was checked; (2) by whom it was checked; (3) the date on which it was checked.

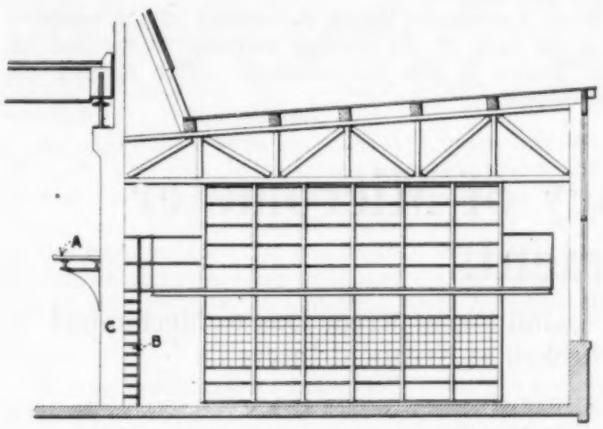


FIG. 3. ELEVATION OF STORAGE RACKS

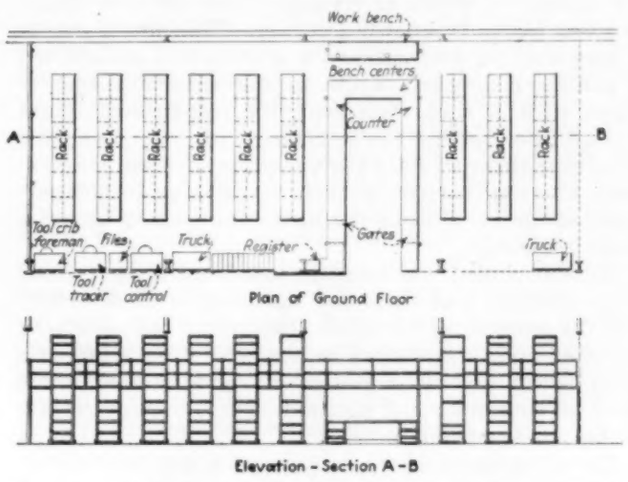


FIG. 4. PLAN OF RACK LAYOUT (ABOVE). FIG. 5. SIDE ELEVATION OF RACKS

NAME Bill Jones

MAN'S NO.	SHOP NO.	PIECE NO.
411	56243	49621
DATE	**MACHINE NO.**	**OPERATION NO.**
3/17/19	421	B-1-1

AMT	SIZE	NAME OF TOOL	TOOL NO.
1		Milling Fixture	17641
		Gang #24	4 Cutters
			AB

FIG. 7. A TOOL REGISTER SLIP

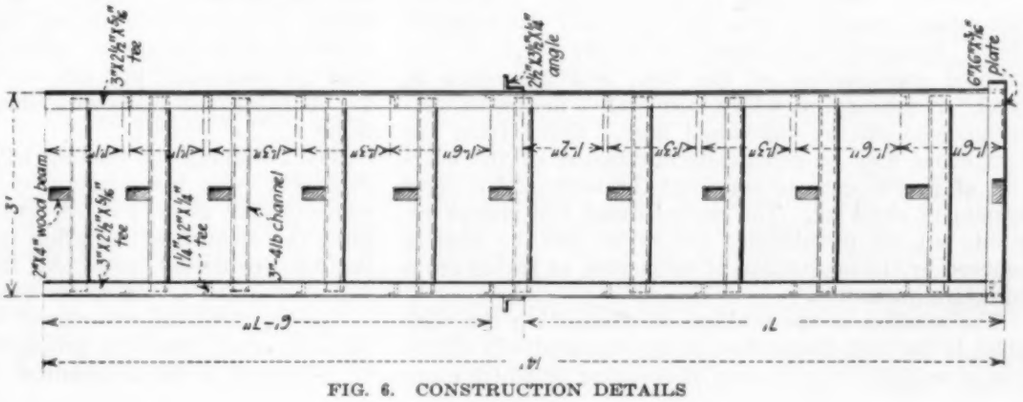


FIG. 6. CONSTRUCTION DETAILS

If, in checking up, the toolcrib foreman finds that tools are lost or broken, he gets a requisition for them from the foreman of the department in which they were lost or broken. If the tools need sharpening or repairing the toolcrib foreman takes the necessary steps to have them made right.

When a tool is broken, lost or misused the workman obtains a requisition from and signed by his foreman, on the toolcrib for a new tool. The toolcrib foreman passes these requisitions to the tool tracer at once for use in keeping up the tool inventory. When the tool tracer has finished with these requisitions he will keep them on file until the end of the month. At the end of each month the tool tracer prepares a report known as the "broken and wornout tool report" and sends it to the tool engineer.

When a workman leaves the employ of the company it is the duty of the toolcrib foreman to see that all tools loaned to him are returned before signing his tool release.

Checking the Accuracy of Micrometer Measurements

Close Measurements with the Micrometer—Possibilities of Error Due to Mechanical Defects—Micrometers Should Be Checked at Frequent Intervals

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

HOW close can you measure with your micrometer, assuming that the micrometer itself is free from error? How sure are you of the accuracy of the tool, and that the measurements you get with it will conform to the standard set by the precision measuring machine?

We speak of tenths of thousandths today as lightly as the toolmaker of a generation ago would speak of "thirty-seconds," and we take our measurements to the fourth place of decimals as confidently as our elders would set their spring calipers to the nearest "sixty-fourth" on their steel scales.

But can we be sure that we are right? Are we certain that there is not the same proportionate departure from accuracy in our finer instruments as existed in the various "scales" that were once the basis of accurate measurement? Dare we assume that there will be no difference between the measurement that we get today from a given piece of work and one that we may take tomorrow or next week from the same piece and with the same micrometer?

By far the greater number of fine measurements taken in tool and gage shops are primarily dependent upon the micrometer; for, though measuring machines and precision gage blocks are of inestimable value upon such work, they are tools rather of reference than of determination, and a faulty micrometer may cause the hopeless spoilage of a piece of work long before the stage is reached where the more precise tools are applicable.

There are two principal causes for error in micrometer measurements; mechanical inaccuracy due to wear, abuse, incorrert adjustment, or faulty work in the original construction of the tool; and difference in "feel," or misreading, which is entirely a matter of temperament with the individual user. Error from the first cause may be practically eliminated by the exercise of proper care in selecting the tools and a rigid system of checking. The second cause will always remain, but its possibilities for error may be greatly reduced by the application of corrective, or rather counteractive, measures.

The solution of the problem of eliminating the variables in the tools themselves is the comparatively simple one of establishing a system of checking by which every micrometer is tested at frequent intervals with standard test pieces of known accuracy. This would not be a very difficult proposition for a shop that maintained a testing laboratory, while in the smaller shops, or shops without such equipment, the requirement might be met by supplying the workmen with test pieces and requiring them to state the condition of their micrometers at given periods to their foremen or to someone selected for his skill in the matter of making accurate measurements.

An experiment was recently conducted in one of our large Eastern tool shops for the purpose of determining the amount of variation that might reasonably be expected from the various causes, and of securing data upon which to base a system of checking that would meet all conditions and eliminate error and uncertainty as far as is humanly possible.

For the purpose of the experiment a new micrometer, previously tested for error in the measuring room of the factory where the most scientific methods of making accurate measurements are available, was taken into the shops along with several Pratt & Whitney "mikechecks" and presented to selected workmen in the machine, tool, gage, and grinding departments with the request that the mikechecks be measured.

The man who conducted the experiment was himself a toolmaker, well known and constantly associated with the men from whom the readings were asked, so that there could be no feeling of embarrassment upon the part of the men that might have existed had the test been conducted by a stranger or an official. The mikechecks chosen were in metric sizes while the readings were asked in tenths of thousandths of an inch, so that the men could not subconsciously make allowance for error because of knowing what size the pieces *ought* to be.

Besides taking the reading with the new micrometer carried by the investigator, each man was asked to measure each piece with his own micrometer to determine the amount of variation there might be between individually owned tools. All the readings were carefully noted and tabulated for comparison.

The result of the experiment showed, as might have been expected, that the principal source of error was to be found in the mechanical defects of individually

owned micrometers. Many of the men, when confronted with the task of making a measurement involving "tenths" were frankly in doubt as to the dependability of their own tools, while others professed to know the amount and direction of error and would make mental compensation for it. Errors from this cause were found amounting to as much as one thousandth of an inch, while the greatest error due to personal "touch" when using the new micrometer was less than one-half of one-thousandth.

As might have been expected, the nearest approach to uniformity was found in the toolroom, where ability to make accurate measurements is one of the primary requisites. In this department the greatest variation in the readings taken by twenty men was 0.0001 in., or one ten-thousandth, when each man measured the mike-checks with the new micrometer. When each man used his own micrometer a variation of 0.0004 in. was recorded.

As the investigator carried with him the recorded findings of the measuring machine, giving the exact length of each mikecheck to six places of decimals, a glance at the figures would show how nearly each man's measurement corresponded to the correct one.

The majority of the men over-read; that is, their measurements exceeded the actual lengths of the pieces by amounts up to one-quarter of one-thousandth. A lesser number underestimated the lengths (the safer way on tool work, for then the pieces upon which you are working is really larger than you think it is) from one-quarter to three-quarters of one ten-thousandth.

The gage-making department, where an equal degree of skill in measuring is required, ran the toolroom a close second; but in this department, as well as in the grinding room, the under reading was slightly greater. In the machine room the variation was somewhat increased; both with the new tool and with individually owned micrometers; some of the latter showing errors as high as one-and-one-half thousandths.

Periodic Checking of Micrometers

Though no definite system of checking has as yet been worked out it is the general opinion both in the shops and the engineering office of the company that every micrometer should be subjected to a uniform and periodic checking against known standards. Compensation for personal error—error due to a too light or too heavy "touch"—would be effected by having each man test and adjust his own micrometer; for if a man were to measure a piece of known dimension and adjust his micrometer to give the correct reading, he would try to secure the same "feel' upon other pieces that he did upon the test piece, and therefore the reading in each case would be correct. It would not do, however, under these circumstances to exchange, or "borrow," micrometers; for in such case readings obtained would show the relative personal error of user and owner.

An alternative method would be to have all micrometers, irrespective of ownership, tested and adjusted by one competent individual, and then try to teach all the men to acquire the same "touch," or sense of feel.

To make either test of real value, readings must be taken at frequent intervals over the entire length of the measuring screw instead of the usual method of testing at zero and again at full opening, for in this latter way a quite considerable error, due to the wear of the screw at intermediate points, might easily remain undetected.

Non-Productive Costs

By F. O. Wells

We have been hearing for a long time now the cry of "Prices must be reduced," and shop managers and production experts in the machine tool and kindred trades have been feverishly going through the shop costs with a fine tooth comb trying to find some way to bring them down to as near the absolute minimum as possible.

Efficiency engineers are all right in their way, but it is a fact that many of them in course of time become so obsessed with the idea of reducing everything to a detail that they lose their sense of perspective entirely.

Nearly every company at some time or other has been bitten and bitten badly by this "system-bug," and if the truth were known, many a promising firm has been systemized out of existence or gone into the hands of the receiver as a result. The writer knows of one factory where it was found that there was one official to every employee.

How to Overcome Leakage

In about seventy-five out of one hundred cases the secret of making price reductions to meet the present business conditions, lies not so much in reducing shop costs, as in reducing the cost of the red tape or non-productive expenses.

The nearer the modern machine shops can get to the simpler methods of the cotton mills, the better it will be for their business. Cotton mills are generally controlled by a treasurer and a superintendent, and the goods sold through a broker who handles the products of a number of mills. Why, a mill has to be of a certain capacity before it can attain the dignity of a superintendent of its own, and in some cases several mills are grouped together under one superintendent. As you will see the overhead is not top heavy with a multitude of high salaried officials and innumerable clerks, and the bulk of the money is invested in buildings, machinery and stock.

Of course the machine tool business cannot be conducted on quite such simple lines as this one product, but there are several ways by which much overhead time and money can be saved.

One way is in curtailing the practice of bringing out a new model every year. By this the writer does not mean that improvements are not to be made, but the heavy expense of new designs, patterns, jigs and fixtures is not justified except the improvement be a radical one.

Another economy which some firms do not yet realize is in confining the manufactured article to as few sizes as possible, and avoiding overlapping.

This brings us to another cost-saving idea of making a complete article in one department, the advantages of which procedure are numerous.

In cases where the different operations on an article or machine are scattered through about ten different departments, it means that ten foremen are needed with probably a clerk to each foreman. This means that each foreman is jealously watching out for his own department. He is not particularly interested in the other departments and so it follows that no two departments are alike in interest on account of the duplication of effort.

When an article is made in one department, which is in charge of a capable foreman who is solely respon-

sible for everything from machining rough castings to assembled product, the following economies have been accomplished:

(1) Closer interest of employees in product as they can see it from start to finish.

(2) Increased sense of responsibility of each workman as he knows that on the accuracy of his work depends the proper assembling of the completed job, under his own foreman—not in some other department.

(3) Ease in locating and correcting faults in workmanship or in raw material, as goods in process are not stored away for six months, but are continuously worked on.

(4) Elimination of 90 per cent of inspection, as the men themselves are responsible to their own foreman and each other and work more on honor.

(5) Reduction of large amount of capital in stored goods in process—consequently quicker turnover.

(6) Cost kept by departments instead of on individuals, and eliminating a vast amount of unnecessary clerical work.

Have Confidence in Men

With regard to having confidence in your workmen and letting them know it, the writer knows by personal experience that by this method, confidence begets confidence, and when an employer has the confidence of his workmen, he has an asset worth a dozen efficiency systems in increasing production and reducing overhead costs.

Another thing is that even in the best regulated of machine shops mistakes will happen and while the delinquent workman should bear some of the blame, he should not carry it all. His position at the bench or machine tends to narrow his vision and he cannot be expected to see things in as broad a way as his employer, who has a chance of a wider outlook on things in general.

If present-day employers would remember that their place is to lead and work with their men, enlightening them on various phases of the business which will be of interest to them, they would find that there would be less necessity for employing driving methods to increase production and lessen overhead charges.

One of the most common faults that inventors and manufacturers have, is to hold to the idea of getting the highest price possible for their article and then to spend large sums of money in selling campaigns to get the article over, whereas a better method is to sell at as low a figure as possible, and increase efforts to manufacture more economically, thus giving larger production and quicker turnover, as the low price helps the goods to reduce selling expense by selling themselves.

This method of low price, fast sales and quick returns is well illustrated by Ford, and in a different way by Woolworth's chain stores.

One method of turning the searchlight on the nonproductive costs of overhead or fixed charges, as the writer prefers to call them, is to see that every possible charge should be entered direct and not lumped together, and also entered in such a way as to be intelligible. Some of the cost sheets made out by these efficiency experts are so weird and wonderful that even our statistical friend Babson would be at a loss to interpret them.

While on the subject of fixed charges it would be well to impress upon employers the wisdom of explaining to the men the reason for applying the fixed charges to the actual shop cost and what they consist of. The employee will then see the necessity for economy in the use of tools, waste, lights, etc., and if the costs are figured by departments as previously recommended, one department can compete with others in friendly rivalry to keep down the fixed charges.

Relative to this subject of waste on the part of employees, we might remind the employers to be very cautious not to give the workmen just cause to criticize the management for wild extravagance, either in the business or in the personnel of the executive. There is nothing that will upset the morale of the workmen more than this, and they will immediately remark, "Aw, what's the use of my working my fool head off and avoiding waste, when those higher up are squandering money right and left in other ways."

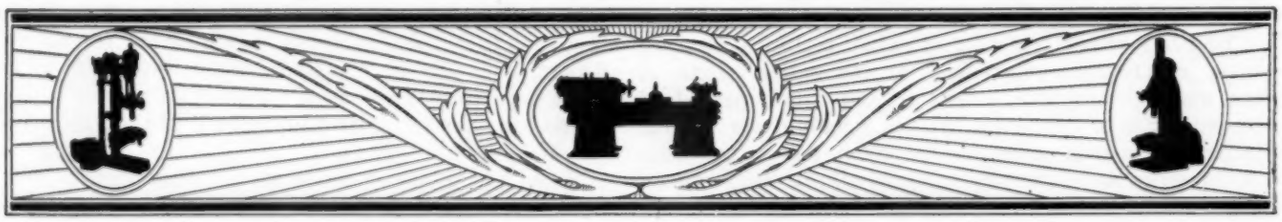
While American manufacturers on the whole are ahead of their European rivals on account of the American habit of specializing in small lines and large sales organizations, as compared with the European idea of a large line and small sales force, yet they will do well not to forget some of the old-fashioned principles of human relationship between master and man, as the further the employer recedes from it, the costlier it becomes to keep up production, and the nearer he approaches the blight of labor troubles.

We are always hearing a lot of talk about vocational tuition for employees being a splendid incentive to increased production, and so it is—but why not try vocational tuition for executives also.

In conclusion the following suggestions for true economy might be summarized:

1. Cut out elaborate cost systems.
2. Analyze fixed charges intelligently.
3. Specialize on few lines, models and sizes.
4. Complete each article in one department—keeping goods moving.
5. Cut out 90 per cent of inspection—establish honor system.
6. Keep price as low as possible—quicken sales.
7. Cultivate friendship and confidence of employees—be human.

If more of the perplexed manufacturers of machine tools and kindred lines, who are struggling in the throes of the present readjustment, will follow on the lines laid down in this article, there will be less need for drastic wage reductions and the consequent friction with the employees, which seems to be the first thought when contemplating a lowering of selling prices to get much-needed business, and the result will be more economical.



Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Press Tools for Trimming a Box Cover

BY S. A. MCDONALD

The tools illustrated in Fig. 1 are for trimming the box cover shown in Fig. 2.

Their construction is as follows: *A* is a machine steel punch holder to which is secured, by screws and dowels, the tool-steel hardened trimming plate *B;* a pressure and locating plate *C* is attached to the punch by the screws *D*, which are held in the down position by the springs *E;* on the side of the punch are fastened, by means of screws and dowels, two hardened steel scrap cutters *F;* the trimming die *G* is of tool steel, toughened so that it will not wear quickly, yet soft enough that it can be upset and sheared by the punch to retain its size. It is a snug fit in the cast-iron die shoe, and is secured in place by the screws as shown.

The operation is as follows: The cover slides down a chute (not shown) and falls on the die where it rests on the trimming edge; two pins *H* prevent the cover from sliding over the die. When the punch descends, the pressure pad locates the cover in the die, and as the punch continues downward, the springs are compressed until the trimming edge shears off the flange, then the pressure pad forces the cover through the die so that it falls into a box below. The flanges sheared off stay on the punch until a sufficient number of them accumulate to fill the space between the shearing cutters *F* and the top of the die. Then as more covers are trimmed the flanges are compressed until the scrap cutters cut through the top ones. The wedge shape of the cutters spreads the scrap so that it falls

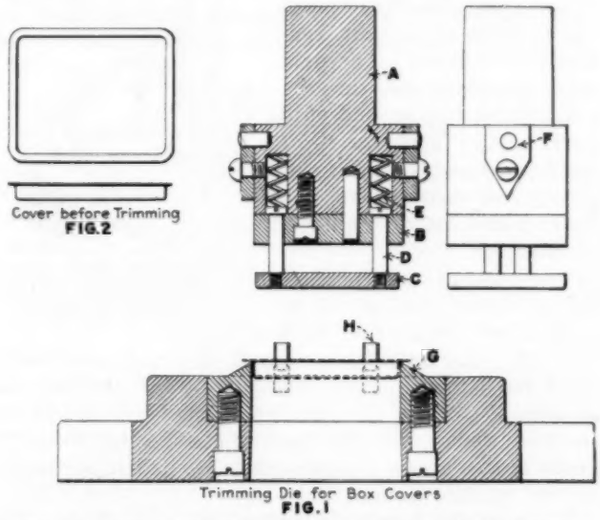


FIG. 1. THE TRIMMING TOOLS. FIG. 2. BOX COVER TO BE TRIMMED

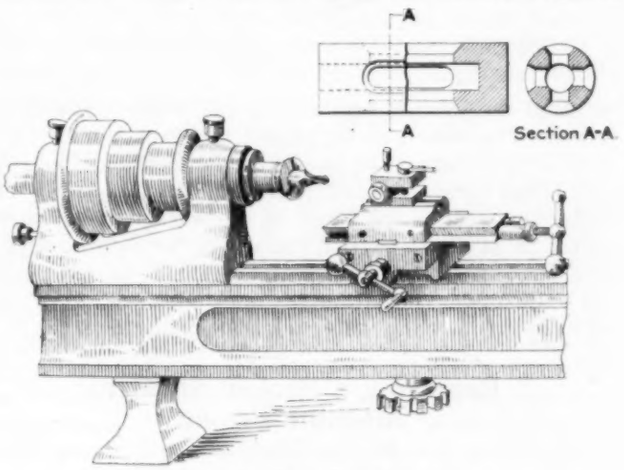
off the punch. As the press is inclined about 45 deg., the scrap does not fall on the die but is caught in a chute that leads to a scrap box behind the press.

A Center Drill Used as a Cotter Drill or End Mill

BY G. G. LITTLE

We had several hundred pieces as shown at *A* in the sketch, to be made of brass. Brass rod $\frac{7}{16}$ in. in diameter was the stock used, and each piece had to have a hole drilled longitudinally through its center from one end, passing to within $\frac{1}{4}$ in. of the other end. This left a closed end tube with walls $\frac{1}{16}$ in. thick.

At four places equidistantly spaced the walls were pierced with slots $\frac{7}{16}$ in. wide by $\frac{3}{4}$ in. long and the corners of these slots were rounded on the outer surface of the tubes. At first all parts made were drilled in a jig and hand finished with file and scraper requiring 40 to 45 minutes each. Owing to the number required



SLOTTING WITH A CENTER DRILL

for this order, a quicker means of slotting the pieces was sought.

Punching was out of the question; our milling machine was too slow and not sufficiently sensitive; the drilling machines were not adaptable to the purpose. As a last resort a 6-in. bench lathe was fitted with a block on the cross-slide in place of the toolpost.

The block was of cold-rolled steel shaped into a jig for securing the pieces one at a time, in such a manner that they could be fed up to a center drill held in a draw-in collet; this feed or movement causing the drill to bore its way into the hole in the center of the piece.

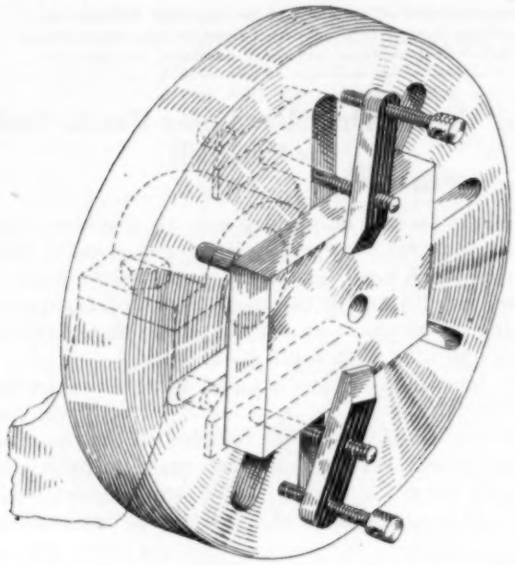
The piece was then fed farther in till the lips of the countersink served to chamfer the corner as the piece was fed across to make the slot. Suitable stops were arranged to limit the movement which saved time in handling the work.

The center drill being two-lipped is adaptable to work of this kind, and if properly stoned for cutting relief will withstand considerable crowding of the work. I milled many of these small slots at 15 sec. per slot (1 min. per piece including changing to next piece ready to cut). One center drill outlasted the entire job.

Handy Use of Parallel Clamps

By H. Willey

Recently the *American Machinist* published several kinks showing the handy uses of a pair of parallel clamps. I am submitting another way in which I have



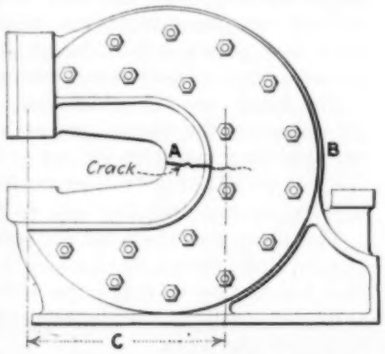
USING TWO PARALLEL-JAW CLAMPS TO HOLD WORK ON FACEPLATE

utilized my clamps for holding die work on the faceplate. The sketch seems almost self-explanatory. One jaw of the clamp, the one with the clearance hole for the clamp screw, is used in back of the faceplate. The other jaw acts as the strap on the work. It, of course, is set off at an angle from the slot in the plate to permit the screw being used. The arrangement permits quite an adjustment for different thicknesses of work and does not require any bolts, washers or blocking.

Repairing a Broken Shearing Machine Frame

By John S. Watts

Some time ago the frame of our shearing machine was cracked by accident, as indicated in the sketch accompanying this article. While it is the fashion to repair such breaks by one or other of the welding processes, I decided that in this case, at least, a stronger job could be made by patching, at a lower cost, and with the further advantage of absolute dependability. Having two circular plates in stock ¾ in. thick, of flange quality, we cut an opening in each, and flanged them to fit over the throat of the shear frame, as shown in the sketch. The plates were then fastened to the shear frame by studs, and to insure that the plates would prevent any opening of the crack when the load was on, the stud holes were carefully drilled so that each stud was a tight fit in its hole. This was accomplished by drilling the plates in place on the frame, running the tapping drill right through both plate and frame, and then removing the plate and running a full size drill through the holes already drilled out to tapping size.



REPAIRING A BROKEN SHEAR FRAME

The reason for flanging the plates around the throat opening was to get a sufficient sectional area of plate to resist the bending moment. The area of steel required was determined by calculating the stress by the beam formula. The bending moment at section *A B* will be equal to the load on the shear knives, multiplied by its distance from the neutral axis of the plate section *C*, the section modulus of the plate being *Z*, and taking f = safe stress, say 15,000 lb. per square inch, we have

$$Zf = LC$$

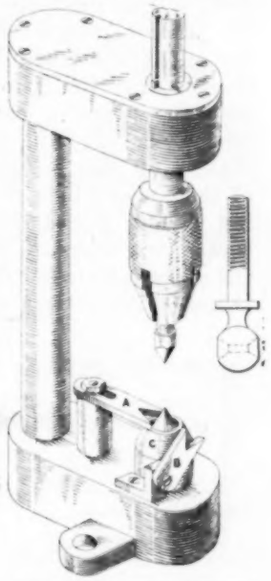
$$Z = \frac{LC}{f}$$

Double Countersinking Fixture

By R. Grant

Some years ago when work was plenty, large quantities of small brass knobs were coming off the automatic screw machines and piling up in the drilling department. Where a hole was to be drilled through the ball at right-angles to the axis and then both sides countersunk deeply to allow a ring to turn freely in the knob. An example of the work is shown in the cut.

The drilling had for years been done in jigs which were slow and unsatisfactory at best, but this condition had been changed by the development of universal compressed air drill jigs that have been described at various times in the *American Machinist*, so that the countersinking could not keep pace and required attention. The fixture shown in the illustration was the result.



FIXTURE FOR COUNTERSINKING BOTH SIDES AT ONCE

The fixture body is cast iron about a foot high and remains permanently clamped to the table of a light, sensitive drill press. The drill press spindle passes through a hardened and ground quill gear in the upper part of the fixture and, by means of a vertical gear shaft and lower gears, drives the lower countersink.

The slotted and notched bar *A* at the rear serves as a stop to locate the work centrally; the adjustable stop *B* in front prevents the work from turning with the cutters, and the vertically adjustable sleeve *C* inside of which the lower countersink revolves, determines the depth of cut for this tool. The depth of the upper countersink is regulated by the stop on the spindle quill.

We kept the lower countersink a little sharper than the upper one so as to insure the work being carried down onto the lower stop before the upper tool should have cut to depth. To leave both hands of the operator free to handle the work, we replaced the usual feed lever with a treadle.

EDITORIALS

Hits—One Hundred per Cent

LAST week we commented on the possibilities inherent in the bombing tests on the old "Alabama" and tried to point out the effects on future warfare. The Alabama has gone to her grave, but in the going she left behind evidence worth far more than her cost.

As reported by the press the final ærial attack with demolition bombs resulted in one hundred per cent of hits, the first "egg" dropping at the foot of the mainmast and turning the doomed ship over on her side. The other bombs fell either on the target or within thirty feet, close enough to cause serious damage by reason of the tamping effect of the water.

Successful as this part of the test was, its significance is dwarfed by the achievements of the preliminary tests with poisonous gas and liquid fire. Even though very dilute gases of the least dangerous type were used, it was clearly shown that it is entirely within the range of probability to annihilate the entire personnel of a ship with ease in this way. One or two small smoke bombs dropped by fast pursuit planes which are almost impossible to hit by anti-aircraft fire would render the target helpless to stop the attack of the heavier, slower bombers. Then either demolition bombs or the more deadly of the modern gases would finish the job.

It may seem that we have devoted an undue amount of space to this particular set of tests, but we feel that it has been justified in view of the probable effect on American industry of the information thus brought to light. Plants building warships will look forward to a less promising future but builders of airplanes and engines should be encouraged. The stimulus to aviation in general, in which the commercial branch will share with the military, will be a factor of prime importance in our national advancement. All in all, we look for important developments to come from the passing of the "Alabama."

The Department of Commerce Survey of Current Business

THE Department of Commerce is certainly to be congratulated on its new monthly supplement to "Commerce Reports" known as the *Survey of Current Business*. We heartily recommend those of our readers who have not seen one of these bulletins to write for sample copies to the Superintendent of Documents at Washington.

The August issue contains seventy-three statistical tables and a four-page summary. Many of the tables are supplemented by small graphs showing relations between quantities, values or index numbers depending upon the commodity. So far as we can determine, every primary statistical record of any importance which is readily available within a reasonable period has been included, from the cost of living to the foreign trade record of the United Kingdom. Figures that would take hours of digging to get together if everyone had to assemble them for himself are placed side by side so that they can readily be compared.

Big business is used to reading such statistics and to making its plans on the general trends indicated by them. It should welcome this convenient form of displaying them.

The little business man should benefit even more for he now gets in one booklet at a nominal price all the statistics he can use and which he could not afford otherwise. His job is to so educate himself that he can read them as readily as his big brother, and grow in business stature himself.

Exchanging Engineers and Their Experience

IT IS a common practice in colleges to exchange professors occasionally, or at stated periods, and with good results. It has been suggested that something of the kind might be a good thing if applied to engineers in various branches; that the information which each could impart to the different industries would be of great value when business again approaches normal.

Electric motor builders, for example, have engineers who have specialized on the various problems of applying motors to machine tools and to machinery of all kinds. This is a matter which interests every progressive builder of machinery. Positive, up-to-date knowledge on motors and motor drives enables the builder to design his machinery to better advantage and frequietly, to save money in the motor mountings or even in the motor itself.

The electric motor builders, in common with all the rest of us, are not burdened with orders at the present time. Their engineers are not busy and yet they do not want to lose the years of experience and training which they represent. They would doubtless be very glad to release some of them temporarily to act as advisers on motor drives to machine builders.

The electric motor builders on the other hand are large users of machine tools and it is hardly to be expected that they are using them all to the best advantage. Some of the experts in machine production could doubtless give much valuable advice as to the best machining methods and put the builders of electrical machinery into position to manufacture more economically when the time comes.

The same sort of exchanging might well be done in other lines to equally good advantage, and on some mutually satisfactory basis.

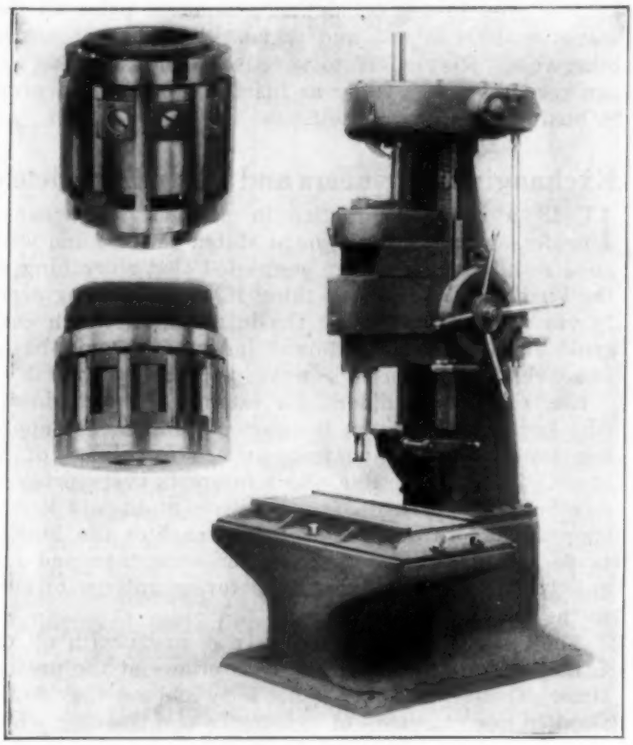
This exchanging of men does not, of course, reduce the expense in any way. But it does secure a decided advantage over the usual plan of retaining them until business returns. With the exchange suggested, the salaries paid become a direct investment in special engineering information and in better machining methods; an investment which can be cashed as soon as the bank (of trade) opens.

The plan has been proposed by one of our keen engineering friends and is worthy of careful consideration. It is not a one-sided proposition—nothing worth while ever is. But it is one which can be pondered to advantage and it is not a very large ball to start a-rolling.

Shop Equipment News

Foote-Burt Combination Ford and Fordson Cylinder Reboring Machine

The Foote-Burt Co., Cleveland, Ohio, has recently adapted its No. 2 Ford cylinder reboring machine to the handling of the cylinders of Fordson tractors. The



FOOTE-BURT NO. 2 CYLINDER REBORING MACHINE

accompanying illustration shows the combination machine, which is of the single-spindle type and intended for heavy duty. The machine was designed in cooperation with the engineers of the Ford Motor Co., it is said, so as to fit it for the use for which it is intended.

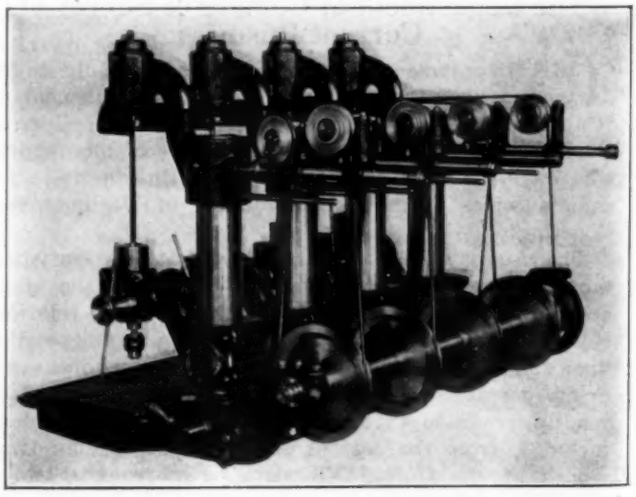
Quick-acting clamps are provided to hold the cylinder block in place while the reboring is being performed. An adapter plate is furnished to permit of the holding of both styles of cylinder blocks. The spindle runs in bronze bearings, the lower bearing being tapered to provide for adjustment, and a ball thrust bearing is used. The spindle is driven through a hardened steel worm and a bronze worm gear, the final drive being through double-pitch spur gears. This driving mechanism is enclosed in an oil bath in the housing of the head. To provide the feed for the cut, the entire head slides on the column, having a vertical travel of 16 in. and being counterweighted. It is stated that there is no necessity for the use of a pilot on the lower end of the boring bar. The machine is driven by belt on a pulley at the top of the head. Only one speed and one feed are provided, these being chosen to suit the type of work to which the machine is adapted. The pulley runs at a speed of 475 r.p.m., the spindle at 28 r.p.m., and the feed is 0.065 in. per revolution. An automatic stop is provided, and a quick-return is obtained by means of a hand lever.

As shown by the insert in the illustration, the cutter used is of the adjustable-size, ten-blade type. It is stated that it can be operated at high speed without producing chatter marks, even though hard spots be encountered in the cylinder bore. The burnishing tool used is stated to give a very good finish to the inside of the bore. The rollers are so mounted that their positions are adjustable. On the down stroke of the spindle they take an angle of approximately 3 deg., which gives the feed for the stroke. After the limit of the cut has been reached, the positions of the rollers are reversed by feeding the spindle upward with the handwheel, so that the angle is 3 deg. in the opposite direction. The feed for the up stroke then continues automatically. The machine has a floor space of 44 by 43⅜ in., and an over-all height of 98¾ inches.

Henry & Wright Class-O Bench Drilling Machine

The illustration shows a high-speed drilling machine recently placed on the market by Henry & Wright, Hartford, Conn., and intended for driving 13/64-in. drills to their full capacity. The machine is equipped throughout with ball bearings of standard design, and careful attention is said to be given by the maker to the proper alignment and adjustment of all parts, to insure smooth running at the maximum speed of 12,000 r.p.m.

Two-step pulleys on the spindle and rear shaft provide for four changes of speed. Belt tension is maintained through the medium of spring-loaded idler pulleys, which are capable of adjustment to give the proper tension in accordance with the size of the drill in use. The driving belt used is round and ¼ in. in diameter. The rear shaft is provided with tight and loose pulleys and a belt shifter that is easily accessible to the operator without changing his position. It is driven from the



HENRY & WRIGHT HIGH-SPEED BENCH DRILLING MACHINE

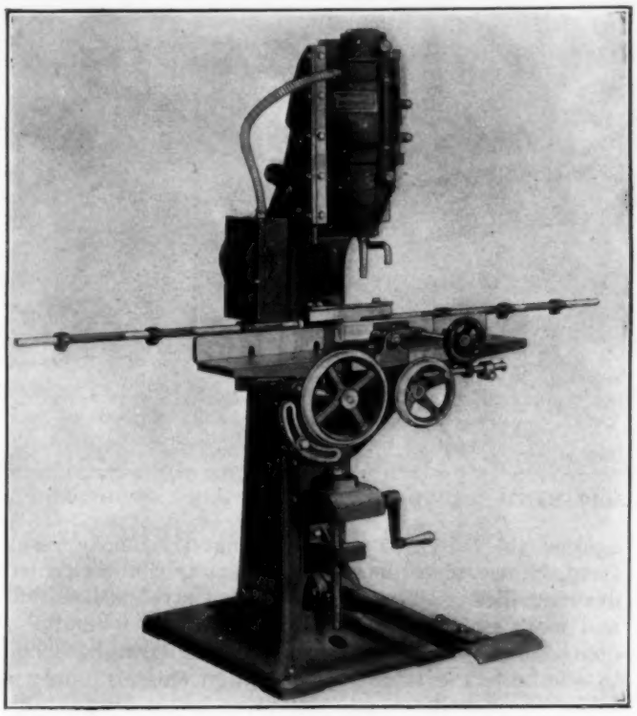
main lineshaft or countershaft by a 1-in. flat belt, and is intended to run at a speed of 2,820 r.p.m.

The weight of the spindle is over-balanced by a short coil spring on the pinion shaft,, thus providing for a quick return and serving in a large measure to overcome the breakage of drills when "breaking through" the work. The lower arm has a vertical adjustment of 6¾ in. on the column, and the rack and pinion feed movement has a range of 2½ in. The distance from the table to the nose of the chuck ranges from 0 to 7⅞ inches.

The machine is ordinarily built with four spindles, but a greater or lesser number may be provided. The spindles are 7 in. apart and the distance from each column to the center of its spindle is 5¼ in. The working surface of the table of the four-spindle machine is 8x29 in.; bench space occupied, 26¼x33 in.; height 22¾ in.; and weight 345 lb. Though designed primarily as a bench machine, it may be placed on a pedestal if desired.

Oliver Motor-on-Spindle Vertical Hollow-Chisel Mortising Machine

The accompanying illustration shows a vertical-spindle, hollow-chisel mortising machine recently placed on the market by the Oliver Machinery Co., Grand



OLIVER MOTOR-ON-SPINDLE MORTISING MACHINE

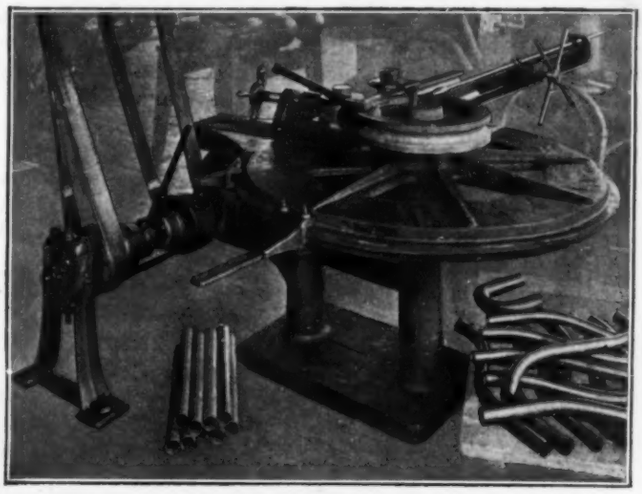
Rapids, Mich. The principal feature of the device to which the maker calls attention is the fact that the motor is mounted directly on the spindle of the machine, being enclosed in the same housing with the spindle and the mechanism of the head.

The motor operates on either two- or three-phase, 60-cycle alternating current at a speed of 3,600 r.p.m. It is called a shaftless motor, because the rotor is mounted directly on the machine spindle, which runs in ball bearings. The position of the motor eliminates the use of countershaft, pulleys and belts, and it also saves floor space. Since it is self-contained, the machine may be given any position in the shop desired, regardless of the position of the line shafting. The maker claims that the drive is very economical in the consumption of power.

An enclosed starting switch with fuses is mounted on the machine and connected by a flexible conduit to the motor. The machine is equipped with a compound table having a feed operated by a handwheel through a rack and pinion and provided with a clamp for the work. The necessary bushings, wrenches and other equipment are provided.

Wallace No. 5-B Pipe-Bending Machine

The Wallace Supplies Manufacturing Co., 420 Orleans St., Chicago, Ill., has recently placed on the market the type of pipe-bending machine shown in the illustration.



WALLACE NO. 5-B PIPE-BENDING MACHINE

The machine is known as the No. 5-B, being adapted especially to the bending of pipe and tubing. It is very similar in design to the No. 5-A machine previously described in the *American Machinist* on page 87, Vol. 53. The machine is known as the No. 5-C when equipped with dies for the bending of angles, channels, tees and other structural shapes.

One of the features of the machine is the hand-operated device for the quick insertion and removal of the mandrel which supports the walls of the tubing from the inside during the process of bending. This mechanism can be seen in the rear in the illustration. The samples of work shown in the foreground are lock-seamed tubes of 0.028 gage steel. The seams are prevented from opening up during bending by supporting the outside wall of the tube by means of the follower bar, which exactly fits the tube on one side. The other half of the circumference is supported by the grooved forming head or die. The walls are supported on the inside by the mandrel, which remains stationary while the tube slips over and away from it as it is bent around the forming head to which it is clamped.

Forming dies or heads up to 50 in. in diameter may be set into the machine. An adjustable bracket having two rolls supports the outside follower bar, and it may be moved back and forth to suit the size of the form. When bending tubing heavier than $\frac{1}{16}$ in. wall thickness, the mandrel for supporting the tube from the inside may be dispensed with, and the forming done by means of the outside follower bar only. Short-radius bends may be made in ordinary iron pipe, such as the piping for refrigeration or steam coils.

The machine can be belted directly to the line shaft,

no countershaft being required. It is equipped with friction clutch pulleys, operated by means of a lever to provide both forward and reverse movement. Two movable stops are provided on the edge of the rotating table, so as to automatically disengage the clutch at the end of the bending operation, and again when the machine has been reversed and returns to its starting position. The machine requires a floor space of about 52 x 66 in. It weighs approximately 1,200 pounds.

Ingersoll-Rand "Imperial Type-XCB" Air Compressor

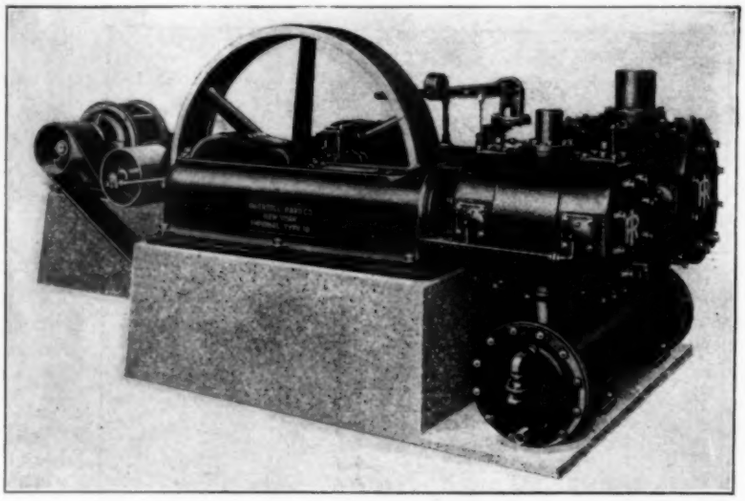
The illustration shows an air compressor recently placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y. The machine is known as the "Imperial Type-XCB" and is belt driven. The principal features to which the maker calls attention are the plate valves for both the air intake and discharge, and the 5-step clearance control for regulating the output.

The method of clearance control has been used in the past on large direct-connected, electric-motor-driven compressors manufactured by the concern, and is said to secure very efficient operation at partial loads. It is especially advantageous for use in installations where the demand varies greatly throughout the day. The compressor is automatically loaded and unloaded in five successive steps through the reduction of or the addition to the clearance space of the air cylinders. The machine can operate at either full, ¾, ½, ¼ or no load, it being stated that at any one step the reduction in the input power is practically proportional to the reduction in the output.

The entire control is automatic, so that if the demand falls off, the machine automatically drops to a lower load point until the demand for air increases. It then automatically assumes the load in the successive steps. The process is controlled by the variation in the receiver pressure. The clearance pockets are integral with the compressor cylinders and the entire regulation is obtained by the control of the volume of air taken in and compressed. With the compressor operating at partial capacity, a portion of the air is compressed into the added clearance space instead of passing through the discharge valves. On the return stroke this air expands, giving up its stored energy to the pistons, so that the power input can be kept proportional to the output.

The inlet valves remain closed on the return stroke until the cylinder pressure equals the intake pressure, at which point the inlet valves are automatically opened and free air is taken into the cylinder for the remainder of the stroke. On the two-stage compressor, clearance space is added for both the high and the low pressure cylinders to give a constant ratio of compression. A maximum demand stop is provided, to prevent the compressor from being operated at any higher maximum load than desired, since the stop can be set for any amount of load desired.

The machine can be furnished single-stage for low pressures and two-stage for higher discharge pressures. The piston displacement capacity for 100 lb. discharge pressure measures from 610 to 1.505 cu.ft. of free air per minute. The stroke of the machine shown is 12 in., the cylinder diameters being 9½ and 12 in. The compressor can be furnished with a short-belt driving attachment employing a floating idler. By this means the length of the belt and the floor space required can be decreased, while permitting of a greater arc of belt contact.



INGERSOLL-RAND "IMPERIAL TYPE-XCB" AIR COMPRESSOR

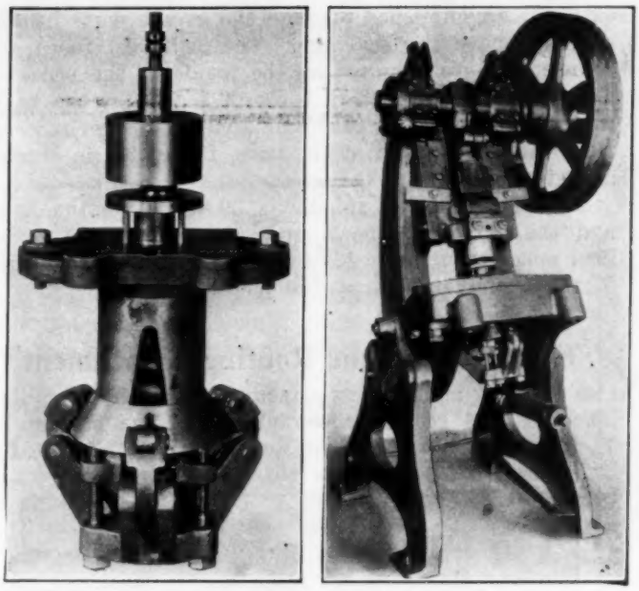
Marquette Even-Pressure Spring Cushion

The view at the left of the illustration shows the even-pressure spring cushion recently brought out by the Marquette Tool and Manufacturing Co., 319 W. Ohio St., Chicago, Ill., for giving a uniform pressure during the entire length of the stroke when drawing a shell on a punch press. With this device, it is said, sufficient pressure is obtained at the beginning of the draw to eliminate the wrinkling of the metal and the unnecessary wear on the dies resulting therefrom; and this pressure is maintained uniformly throughout the drawing of the shell, thus avoiding the straining of the metal to the breaking point toward the end of the stroke.

By doing away with the increased pressure toward the bottom of the stroke, back-lash of the press is eliminated, it is claimed, which avoids the hammering against the clutch of the press that frequently results from the use of ordinary coil springs in connection with drawing dies. Also the metal is not stretched so much and more even edges on the shell are the result. In many cases, the edge is said to come straight enough to eliminate the trimming operation entirely, and consequently permit a smaller blank to be used.

The cushion is so constructed that the adjustment is left undisturbed when the attachment is removed from the press, which saves time when again setting the dies. The device is made entirely of steel. It is attached to the press by means of a single bolt which screws into the bolster plate, or in the die itself, in the same manner as rubber bumpers or coil springs are fastened. No special drilling of the press or bolster is required and the device will fit in any ordinary drawing die. On the right of the illustration the cushion is shown in place on a press. The attachment takes up very little room under the bed of the press, so that it is not in the way of the operator when he is operating the press in a sitting position.

When operating, the punch in descending on the blank forms the shell over the center-block. The die-pins



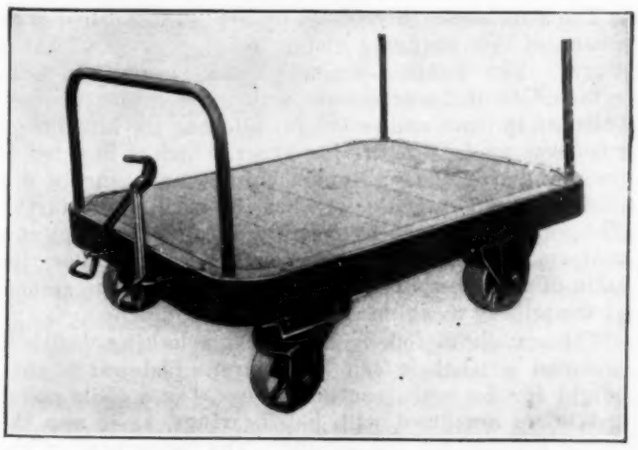
MARQUETTE EVEN-PRESSURE SPRING CUSHION

resting on the pinplate force the spring housing down, compressing the spring against the spring washer carried by the lower ends of the equalizing levers. When the spring housing descends, it carries along with it the adjusting screws, which allow the equalizing cam to descend by yielding to the pressure of the rollers at the upper ends of the equalizing levers. The angle on the cam, causing the equalizing levers to rotate about their journals and permitting the spring washer to descend, allows on a long draw only a slight compression of the spring. On a 1½-in. draw the compression of the spring is ⅜ in. During the return stroke, the same actions take place in inverted steps, preventing the hammering on the back stroke.

It is stated that in many cases where two or more drawing operations were formerly used, the attachment enables the performing of the job in one operation. The cushion is of special value in drawing lithographed metal, eliminating scratching of designs.

"Brute" Heavy-Duty Trailer

The Sharon Pressed Steel Co., Sharon, Pa., has recently added to its line the heavy-duty trailer shown in the illustration. The trailer can be pulled by an industrial tractor or motor truck. It is intended for



BRUTE HEAVY-DUTY TRAILER

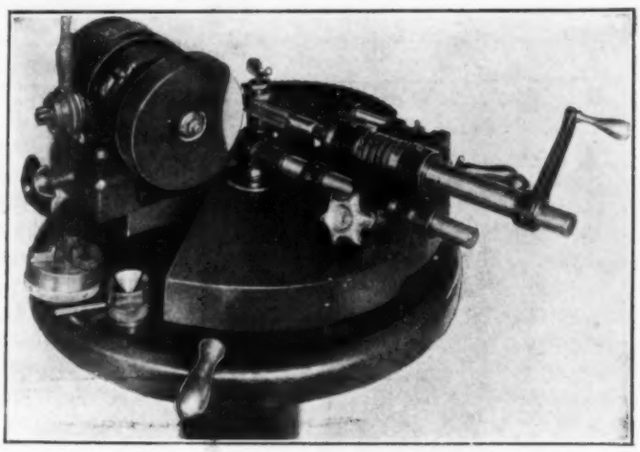
carrying heavy loads, and it is said that it will not tip even though heavily loaded at only one end.

The frame is made of pressed steel, the outer members being 4¾-in. channels of ¼-in. steel. It can be made to any length up to 72 in. and width up to 50 in. The side rails fit into a pressed-steel corner channel, which has a 6-in. radius with a hole in the top flange for a stake pocket. The two cross members running lengthwise are made of 3-in. channels, as are the rear wheels and front caster supports.

The rear wheel bracket is a stamping of ¼-in. steel. The rear wheels are made of malleable iron, and have six double-web spokes, 3½-in. face, 3-in. Hyatt roller bearings and a 1-in. hardened and ground shaft. The front casters are bolted to pressed-steel stampings, which are riveted to the side rails and two front cross members. They are equipped with ball and roller bearings. The top is of 1¼-in. seasoned oak, with the edges placed under the side and end rails. The truck can be equipped with one or two couplers, which are ⅝-in. steel forgings. The outfit weighs 362 pounds.

Bickford-Switzer Tap-Grinding Machine

The accompanying illustration shows a tap-grinding machine recently placed on the market by the Bickford-Switzer Co., 50 Norwood St., Greenfield, Mass. The



BICKFORD-SWITZER TAP-GRINDING MACHINE

machine is similar in appearance to the company's drill grinding machine described on page 573, Vol. 54, of the *American Machinist*. It is intended to sharpen any style of tap having any number of lands or flutes from two to six, by grinding an eccentric relief on top of the cutting land. The limit of the capacity is 1½ in. in diameter for hand taps, 1¼ in. for tapper or machine nut taps, and 2 in. for pipe taps.

The machine grinds the different lands of the tap consecutively, a cam on the main or work-carrying spindle riding against a shoe, and thus causing the tap to approach and recede from the wheel as it is revolved on its own centers. The squared end of the tap is driven by a bell center, while the point is supported by a male or female center as required, these two centers being mounted on a revolving plate. The different cams are made together in a single shell and mounted on the work spindle in such a manner that when the spindle is turned in a backward direction the cams do not revolve, but will start forward from any position when the spindle is turned forward. This arrangement assists in setting the tap to bring the proper relative position be-

tween the land and the cam. It is only necessary to turn the tap backward until the contact-point of the wheel is in a position between two lands, and then turn the tap forward.

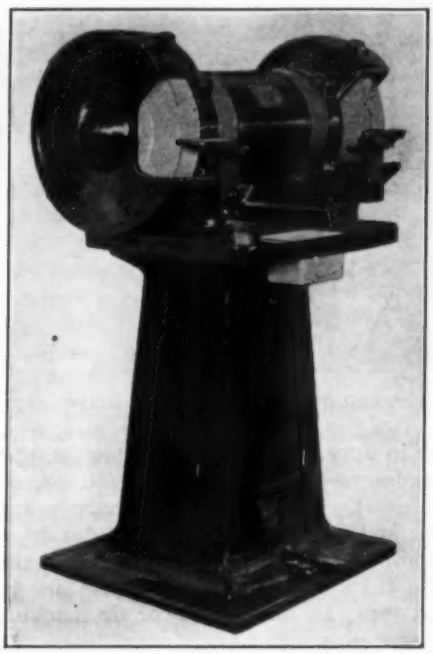
The head which carries the main spindle is arranged to clamp in the desired position on the rocker shaft, a flat spring underneath holding the head over to keep the particular cam in use in contact with its shoe. A lever at the left feeds the work forward to a position opposite the wheel, when a lever at the right sets it to the desired angle, and the wheel is fed in as the work is revolved by means of the crank.

The angle of the work is changed as it passes the wheel, giving a rounded contour where the angle of the bevel near the end of the tap approaches the parallel sides. This feature is said to prolong the life of the tap. It is also valuable when sharpening chucking reamers, saving the use of a hone to take off the sharp corner. The machine can sharpen countersinks and chucking reamers having not more than six flutes.

The machine is self contained, and is equipped with a ¼-hp. motor for either alternating or direct current. It is mounted on a column and weighs 300 pounds.

Van Dorn Heavy-Duty Grinder

The Van Dorn Electric Tool Co., Cleveland, Ohio, has recently put on the market the heavy-duty, ball-bearing electric grinder shown in the illustration. The machine is equipped with two 14 x 2½-in. face-grinding wheels mounted directly on the 1¼-in. motor shaft. They are enclosed in heavy wheel housings, the ends of which are removable. If desired, an eye shield and exhaust ducts can be attached to each guard. The tool rests have both horizontal and vertical adjustments. An aluminum water pot is set in the table in front of the motor. The motor has a normal continuous rating of 4 hp. It is ordinarily furnished to operate on 3-phase, 60-cycle, alternating current, of either 220 or 440 volts, although motors for special conditions can be furnished. The speed is ordinarily 1,200 r.p.m. The motor housing is smaller in diameter than the grinding wheels, so that long pieces can be ground without interference from the housing. The housing is completely enclosed and dustproof, a fan within the motor furnishing ventilation. Where excessive dust is encountered, fresh air can be piped to the intake end of the housing.



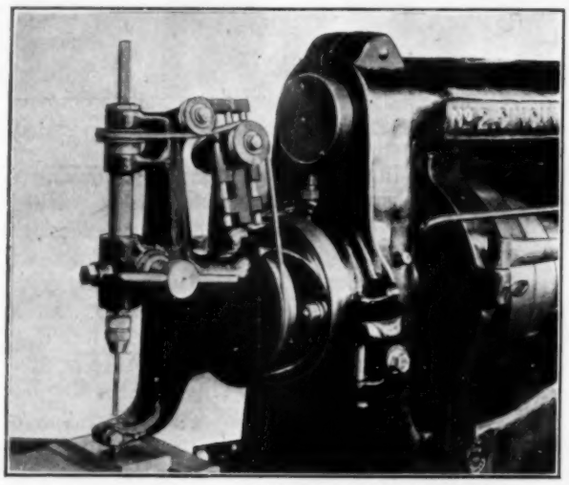
VAN DORN HEAVY-DUTY GRINDER

The armature is mounted on ball bearings, and lubrication is accomplished through the grease ports located directly above the bearings. The switches, fuses and connections are mounted on the inside of the pedestal. The cable conduit enters through a hole in the back, so that no wires or electrical appliances are exposed. By means of a pedal at the base, the motor is started and stopped.

The center of the spindle is 39 in. above the floor, and the grinding wheels are set 25 in. apart. The floor space required is 22½ by 24 in., and the net weight of the machine is about 700 pounds.

K-N Spotting and Routing Attachment

A spotting and routing attachment for use on milling machines has recently been placed on the market by E. L. Krag & Co., 50 West Randolph St., Chicago, Ill.,



K-N SPOTTING AND ROUTING ATTACHMENT

the device being made by Franz K. Krag, Chicago, Ill. The attachment, which is shown in the accompanying illustration, is intended for the laying out and drilling of holes up to and including ⅞ in. in diameter in dies, jigs, templates, master plates and similar work that requires great accuracy. The method of performing the work is intended to replace that of locating holes by means of buttons, and it is said that the work can be done very much more quickly and cheaply by the use of the attachment. The device can be supplied for all standard makes of milling machines, being ordinarily attached to the No. 1, 1½ and 2 sizes.

The attachment is mounted on the milling machine by means of one swinging clamp, using only one locking screw. The locating screw in the base, when once adjusted to the machine on which the device is used, is locked in place and serves for aligning the attachment whenever used. The driving arbor, which is inserted in the spindle of the milling machine, has a spring dog that engages automatically when the machine is started. The spindle is driven by mean of a round belt kept at a uniform tension by a compensating spring idler, the ratio of the speeds being seven to one with the spindle of the milling machine.

The spindle is fed by hand, and a locking device is provided so that it can be securely fastened at any height for use when routing work. The spindle pulley and idlers are fitted with ball bearings, as is also the thrust bearing for the spindle. The lower part of the head carries the guide bushing for the drill, the bracket

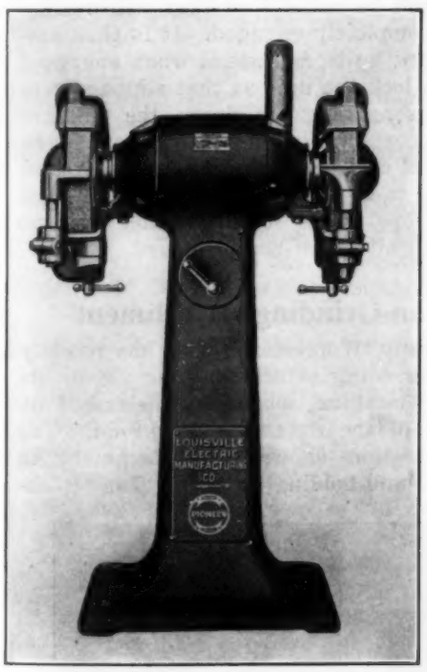
being cast in the same piece with the spindle housing. The attachment is ordinarily furnished with one routing bushing, one intermediate bushing and five drill bushings ranging in size from $\frac{1}{8}$ to $\frac{1}{16}$ in. in diameter, for steadying the drill.

When in use, the knee of the milling machine is ordinarily locked in place, the vertical adjustments being made by means of the spindle of the attachment. The work is moved under the attachment by the use of the feeds on the table of the milling machine. For work on scientific instruments where absolute accuracy is required, the attachment can be used in conjunction with the Johansson compound slide, thus permitting of great precision in laying out work.

"Pioneer" Electric Floor Grinder

The Louisville Electric Manufacturing Co., Louisville, Ky., has recently placed on the market the "Pioneer" electric floor grinder shown in the accompanying illustration. The machine is of a symmetrical design, so as to prevent the accumulation of dirt in so far as possible. The motor is ventilated, the air intake being so located that clean air is drawn through it. It can thus be operated continuously without exceeding the safety limit of temperature. For intermittent duty, it is stated that the motor will operate satisfactorily with the air intake closed.

The machine is provided with ball bearings having housings so constructed that the bearings will be kept free from dirt. Steel safety hoods are provided, with hinged side walls so that the wheels can be easily changed. The toolrests are adjustable, and their positions can be easily changed. The starting switch for the motor is enclosed in the column, and a water pot can be attached to the column if desired. The grinder requires a 2-hp. motor, which can be furnished for either direct current or 60-cycle alternating current, the no-load speed being 1,800 r.p.m. for either type. The wheels used are 12 x 2 x 1 in. in size, and the arbor is 1 in. in diameter between the flanges. The distance between the wheel centers for the alternating current machines is 22 in., while it is 28 in. for the direct-current machines. The height to the center of the spindle is 38 in., and the floor space required is 28 x 19 in. for the alternating current machine and 34 x 19 in. for the direct current machine. The weight is 400 pounds.



PIONEER ELECTRIC FLOOR GRINDER

Pratt & Whitney No. 3 Bench Hand Milling Machine

A hand milling machine for bench use, now manufactured by Pratt & Whitney, Hartford, Conn., is shown in Fig. 1. This little machine is only 21 in. high and occupies a bench space of but 22 x 25 in., yet it has all the features of the larger floor type of machine and some additional ones.

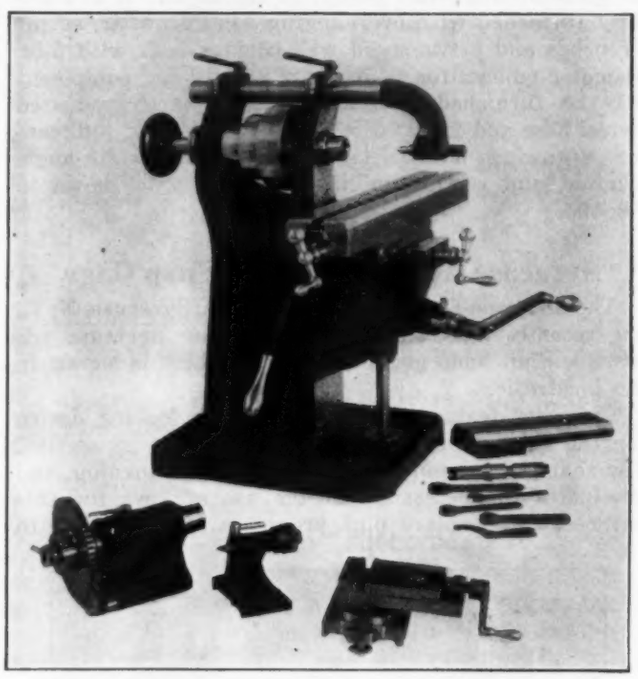


FIG. 1. PRATT & WHITNEY BENCH HAND MILLING MACHINE

The spindle is of tool steel, hardened and ground, as is also the double taper front bearing. The rear bearing is of non-gran bronze, and both bearings are adjustable to compensate for wear. The spindle and drawbar are the same as corresponding parts of the No. 3 bench lathe, hence all spindle attachments are interchangeable. Spindle speeds range from 153 to 1,510 r.p.m. A three-step cone is provided for a 1-in. belt.

The table has a working surface of $2\frac{3}{4}$ x $17\frac{1}{2}$ in. The sides of the table are beveled to an angle of 30 deg. for the purpose of locating accurately all attachments used thereon. It has both screw and rack movement, the former covering a distance of $8\frac{1}{4}$ in. and the latter 4 in. The rack movement may be locked in any position and the feed continued by means of the screw. The saddle has a crosswise move-

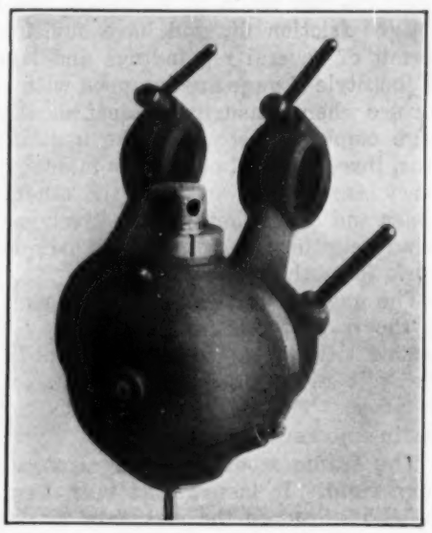


FIG. 2. VERTICAL ATTACHMENT FOR BENCH HAND MILLING MACHINE

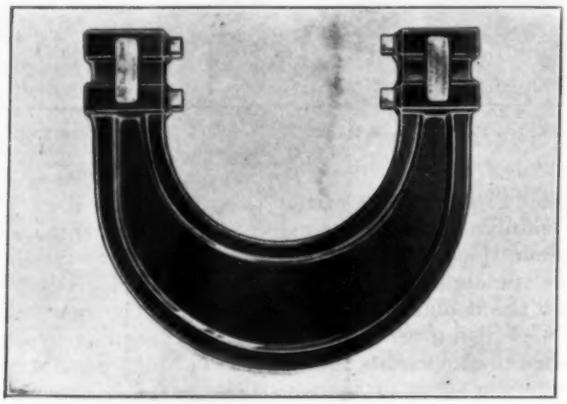
ment of 2⅞ in. and the knee may be adjusted vertically through a range of 6½ in. All screws are fitted with micrometer dials graduated to read to thousandths of an inch.

The machine weighs 185 lb., with an allowance of 50 lb. additional when boxed for shipment. It is regularly furnished with overhanging arm, drawbar, set of wrenches and a two-speed wall countershaft with 5-in. diameter pulleys for 1¼-in. belt. Additional equipment may be furnished as follows: Vise with graduated swivel base and jaws 2⅞ x 1⅛ x ⅝ in.; index quill center to swing 5 in.; tailstock; arbors; right-angle adapter, and vertical milling attachment as shown in Fig. 2.

Syracuse Adjustable-Limit Snap Gage

The Meldrum-Gabrielson Corporation, Syracuse, N.Y., has recently placed on the market the Syracuse adjustable-limit snap gage, Style A of which is shown in the illustration.

The chief feature of the gage is the locking device for the measuring pins, which are square in section. The shape of the pins prevents them from turning, and eliminates the necessity for the use of keys for this purpose. The square pins present a straight edge to



SYRACUSE ADJUSTABLE-LIMIT SNAP GAGE

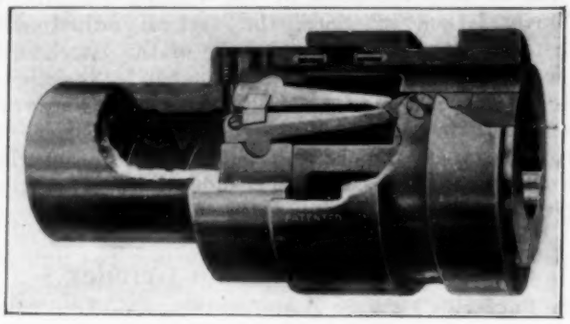
the work, and, having a greater wearing surface, are said to maintain parallelism better than the round pins. The pins are made of hardened tool steel, ground to a tight friction fit, and have sufficient adjustment to permit of several regrindings and lappings. The pins of the Style-B gage are equipped with rectangular anvils for use when measuring against shoulders. The Style-C gage employs, instead of the usual "go" and "no-go" pins, three pairs of pins. The middle pins are set to the exact size of the work and the other two pairs to the upper and lower limits, respectively, so as to enable the rapid selection of under- and over-side pieces of the work from the same lot.

The gage is adjusted by turning an adjusting screw at the rear of each measuring pin. The small conical headed locking screw is then turned, so as to expand the split adjusting screw and lock both it and the pin in place. The head can be filled with sealing wax, leaving no screws exposed.

The frame is of fine gray iron, and is said to be very rigid. It is provided with two ground surfaces on which to place the necessary markings. The tool is made in twenty-four sizes to fit work up to 12 in. in thickness, although larger gages can be furnished.

Johnson Friction Clutch With Positive Lock

The Carlyle Johnson Machine Co., Manchester, Conn., has recently provided the friction clutch which it manufactures with a positive locking feature, so that slippage



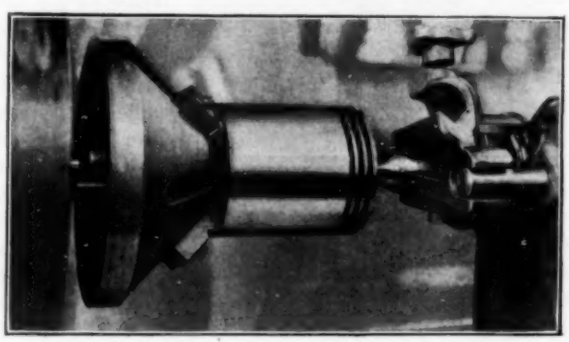
JOHNSON LOCKING FRICTION CLUTCH

can be prevented after the clutch is completely engaged. When first thrown into engagement, the action of the device is the same as on the standard clutch. The outside shifter sleeve forces the sliding wedge between the two toggle levers to expand the friction ring, so as to grip the inside surface of the cup member. When the clutch has been completely engaged, and the speed of both parts is the same, pins on the outside shifter sleeve move up so as to engage those on the clutch itself, there being six pairs of pins spaced around the clutch.

The illustration shows the pins in the disengaged position, but it should be noted that they will overlap when the clutch is completely engaged. It is thus possible to gradually pick up to full speed when engaging the clutch, and then lock the unit so that slippage cannot occur. When disengaging the clutch, the pins are first brought out of contact, and then the clutch can be slipped or disengaged entirely. The maker states that the clutch is adapted to a variety of uses on mechanical drives under conditions where it is desirable that no slippage occur after units have been engaged.

Norton Piston-Grinding Attachment

The Norton Company, Worcester, Mass., has recently developed a piston-grinding attachment for use on its autopart regrinding machine, which was described on page 1017, Vol. 54, of the *American Machinist*. The accompanying illustration shows the attachment in place on the machine and holding a piston. The attach-



NORTON PISTON-GRINDING ATTACHMENT

ment is universal in that it is adapted to the holding of all sizes and styles of automotive pistons from 2¾ to 7½ in. in diameter. It is stated that the time required for

changing from one size of piston to another is less than two minutes.

The fixture consists of a dead center, upon which revolves a cast-iron cone having three dove-tail slots. In each slot is mounted a hardened tool-steel slidable member, the upper surface of which is ground conically. In each jaw is turned a transverse groove, which permits the corner of the abrasive wheel to travel beyond the end of the piston without interference. The jaws are slotted longitudinally and locked in place by means of taper-pointed screws.

Since the surfaces upon which the piston rests are elements of a cone, an accurate setting of the jaws is not necessary. They are merely set by means of the eye to bring the clearance groove in the proper position. The cast-iron cone is driven by the regular drive pin extending from the faceplate of the machine into a cored slot. The piston itself is driven by means of a spline made of a small piece of sheet steel screwed to the side of one of the jaws. Ordinarily, a shallow slot is filed in the inside of the skirt of the piston to engage this spline. Where it is not desirable to slot the skirt, a special driver is furnished that is adjustable to fit all sizes of pistons.

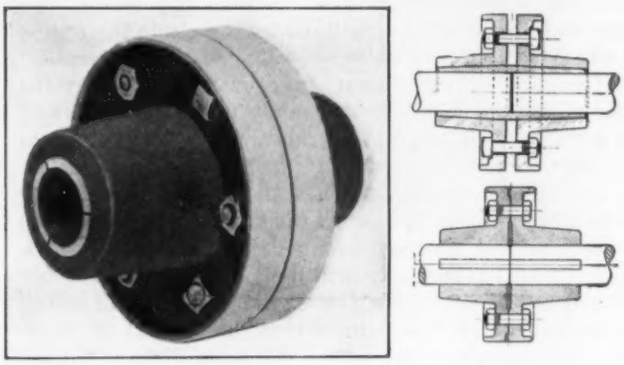
In case that the sliding jaws become worn, they can be dressed by setting the fixture in the adjustable center-grinding attachment furnished with the machine. The bearing of the cast-iron cone on the end of the dead center is tapered, and wear is taken up by turning a threaded collar back of the cone. Oiling facilities are provided by means of holes drilled to the inside of the bearing. The attachment is designated as No. 509.

Hilliard Shaft Couplings

The Hilliard Clutch and Machinery Co., Elmira, New York, has recently placed some shaft couplings on the market. On the left of the accompanying illustration is shown an assembled view of a keyless compression coupling. The interior construction of the device can be seen in the line drawing shown at the top and on the right side of the illustration. The coupling consists of two flanges bored tapered, and one slotted sleeve bored to the shaft size and turned on the outside with a double taper to match the flanges. When installing, the center of the coupling is located directly over the joint of the two shafts, and the flanges are drawn together by means of bolts. Due to the conical shape of the split sleeve, the shafts are gripped tightly so that slippage is prevented.

Couplings of this type can be supplied for reduced diameters, although it is stated that they should not be used to connect shafts varying more than ½ in. in diameter. The couplings are made in a range of sizes in ⅛-in. steps to fit shafts from ⅝ to 3 in. in diameter. The outside diameters vary from 3¾ to 9¾ in. and the overall lengths from 4 to 11½ in. The coupling provides a means of very conveniently connecting shafts without machining them, and it will transmit considerable power.

The line drawing at the bottom on the right of the illustration shows the construction of the flange coupling recently placed on the market. This coupling is made in sizes for shaft diameters from ⅝ to 5½ in., being provided in ⅛-in. steps. The outside diameters of the flanges vary from 3¾ to 15 in., while the lengths of the couplings vary from 3½ to 15⅜ in. The coupling illustrated is of the male and female type, a flange being turned on the outside edge of one of the members to fit in the groove turned in the other member. This style, which enables the closer and more accurate fitting of the parts, is ordinarily used for couplings over 3 in. in



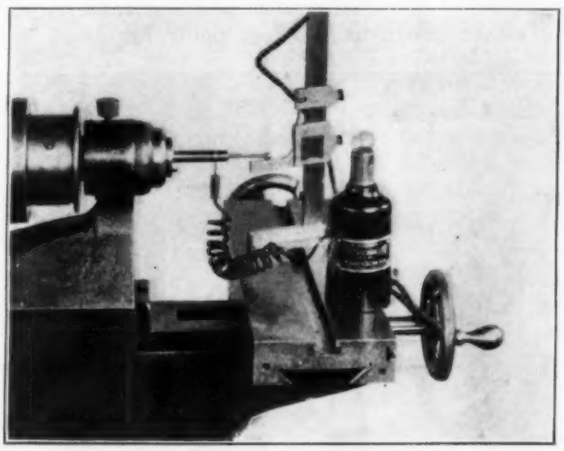
HILLIARD COMPRESSION AND FLANGE COUPLINGS

diameter. For shafts smaller than 3 in., the plain type is used, the bearing surfaces of the members being plane. For connecting shafts of different sizes reducing couplings can be furnished.

Hansen "Electrocator"

A device intended to facilitate the exact location of a given point, as upon a jig or fixture to be machined, with reference to the center line of the revolving spindle of the machine which is to do the work, has been brought out by S. M. Hansen, 601 Washington St., Lynn, Mass., and is being marketed by the Bely Sales Co., of the same address.

This device, sold under the name of the "Electrocator," consists of a small electric transformer, an electric lamp, and a "ball wiggler" similar to that commonly used by toolmakers in centering up work. The wiggler, one end of which is insulated electrically from the other, is placed in a collet or attached by other means to the spindle of the machine to be used. Electrical connection is established with the free end by means of a small spring yoke at the end of the conducting wire, which yoke allows the wiggler to revolve without interrupting the flow of current. The circuit is completed through the lamp, the secondary coil, the base of



HANSEN "ELECTROCATOR"

the transformer resting upon the machine table, and any piece of metal that may establish electrical contact between the machine and the outer ball of the wiggler.

The manner of using the instrument is shown in the accompanying illustration. The shank of the wiggler is held in the draw-in collet, and a vernier height gage set to the required distance is placed on the table of the machine. Upon starting the machine the ball at the outer end of the wiggler will describe a circle the center of which is the exact center of rotation of the spindle.

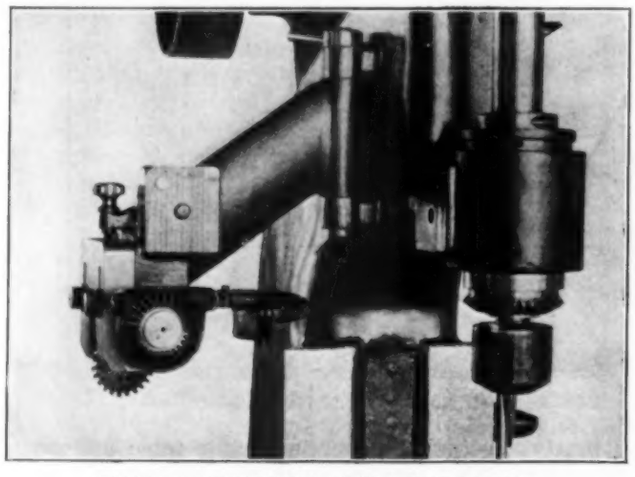
After placing the height gage or size block on the table of the machine approximately under the center of the gyrating ball, the table is raised until the ball strikes the gage, causing the lamp to flash at each revolution. As the table continues to rise, the circle described by the ball becomes smaller, until the true center of rotation is reached and no movement of the ball is apparent. At this position the lamp will burn steadily. A further upward movement of the table will cause the ball to roll off the gage, and it is claimed that the amount of movement between the point where the lamp flickers perceptibly and where the ball rolls off the gage is less than 0.0002 in.

The device is strongly built and will withstand any ordinary amount of abuse. The only fragile part is the bulb of the electric lamp, which is the standard 6-volt dash lamp commonly used on automobiles. The device is furnished with a cord and a plug for attaching it to a lamp socket. Alternating current must be used.

Cherrying Attachment for Pratt & Whitney Die-Sinking Machine

The Pratt & Whitney Co., Hartford, Conn., is supplying for its die-sinking machine an attachment by means of which a formed cutter may be sunk in the metal to be worked, to a depth practically equal to its own radius. The attachment is in the form of a swinging bracket permanently attached to the side of the column of the machine, and when not in use is swung out of the way as shown in the illustration. It may be quickly swung into the operating position, where it is fastened by means of a bolt and dowels to a pad or boss upon the side of the lower spindle bearing.

The peripheral teeth of the cutters are made of such form that the back of each tooth corresponds to the working face of an involute gear tooth; and the cutter is thus driven from its periphery by means of a pinion which is a part of the attachment. The cutter revolves upon adjustable sliding centers, employing either the usual 60-deg. point for small cutters or cylindrical plugs for supporting the larger sizes. The slides are so made that they do not come in contact with the surface of the work until the cutter reaches one-half its diameter in the work.



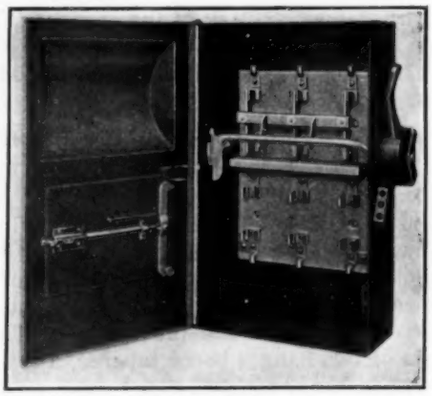
PRATT & WHITNEY ATTACHMENT FOR "CHERRYING" DIES

Different sizes of pinion are furnished for the various cutters that may be used. The drive is through a pair of miter gears from the spindle of the machine, and these gears are covered by easily removable guards when the attachment is in use. The end of the machine spindle is threaded to receive the driving gear, and the driven gear is mounted upon a friction device which permits the gear to slip before the limit of resistance of the cutter is reached, thereby reducing the chance of breakage of the cutters.

The device is not intended for use in sinking an impression in solid metal, though it may be so used if sufficient care is exercised and time allowed, but is rather for the purpose of bringing such an impression to exact size and form after the bulk of the metal has been moved by a chisel or other means. Cutters from 1 to 6 in. in diameter may be used.

Westinghouse Small Motor Starter

The type of motor starter shown in the illustration and known as the type WK-30, and which is said to provide complete protection to both the operator and the motor, has been recently placed on the market by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., for starting small alternating-current motors by connecting them directly to the line. The starter consists essentially of an enclosed quick make-and-break knife switch, which is operated by an exterior handle. It protects the motor from overloads both when starting and when running, because it is equipped with thermal cut-outs which open the circuit on dangerous sustained over-loads, but which do not operate under harmless momentary over-loads. The cut-outs resemble cartridge fuses, but are not interchangeable with fuses. They operate by fusing a special washer, which can be quickly replaced at small cost.



WESTINGHOUSE SAFETY STARTING SWITCH

All parts are enclosed, so that the operator cannot touch live contacts. A door gives access to the cut-outs, but is interlocked with the switch and cannot be opened unless the switch is in the off position, when all accessible current carrying parts are dead. If desired, the door can be padlocked. It is also possible to lock the handle in the off position with three separate padlocks, for the protection of those working on machinery controlled by the switch.

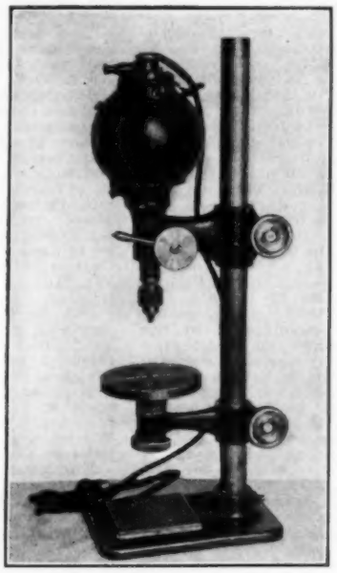
These starters are made in sizes for a.c. motors up to 3 hp. and 110 volts; 10 hp. and 250 volts; and 10 hp. and 600 volts. The type WK-55 starter is similar to the WK-30 just described, but it is made for rough service.

The capacity and arcing arrangements enable the switch to break the locked current of an alternating-current motor when operating with a full-load current equal to the rating of the switch.

"Model" Bench Drilling Machine

The Model Specialty Co., 401 East 19th St., New York, N. Y., has recently placed on the market the small portable bench drilling machine shown in the accompanying illustration. The machine is intended for accurate work and for all-around shop use where a small bench drill is adaptable. Due to its light weight, the machine is very easily carried, as it weighs only 34 pounds.

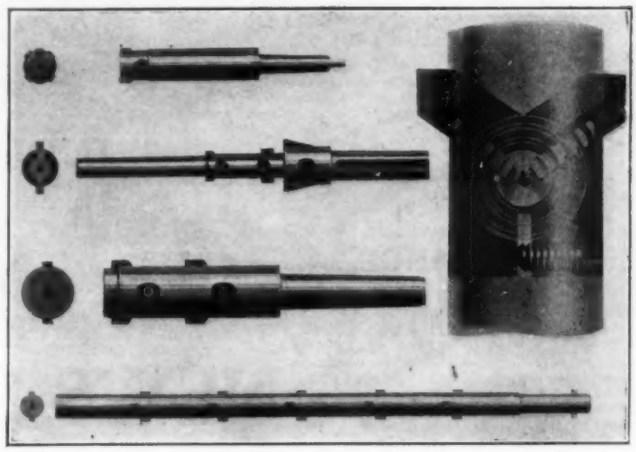
The base of the machine is 9 x 6 in. in size, with a 4 x 4-in. elevation finished on it. The round column fastened to the base is high enough to permit of drilling objects 18 in. in height from the base of the machine. The table is provided with V-grooves, to eliminate the use of V-blocks, and it can be adjusted vertically on the column. The table can be tilted to any angle desired, and then locked in position by means of a screw. Its shank permits of revolving the table, and then of locking it in position by means of a knurled nut underneath the arm. The table is 5 in. in diameter, and when lowered provides a maximum space of 14 in. between the bottom of the chuck and the table surface. The head carrying the spindle and motor can be positioned at any point of the column. The spindle is driven directly from the motor, and it slides vertically in the hollow armature shaft. Bronze bearings are employed, except the thrust bearing, which is of the ball type. The feed is actuated by a small lever through a rack and pinion. The spindle travels 1¾ in., and a long slide is provided to give rigidity. The motor is of the direct-current, inclosed shunt type, operating at 1,800 r.p.m. on 110 volts. It is said to be large enough to drill holes up to ¼ in. in diameter in steel. Motors for alternating current and for special voltages can be supplied. A Jacobs chuck and an extension cord with a socket are furnished with the machine.



MODEL BENCH DRILLING MACHINE

Detroit Adjustable Boring Bars

The Firmhil Machine Supply Co., 602 Kerr Bldg., Detroit, Mich., has recently placed on the market the Detroit adjustable boring bar manufactured by the Power-Vosberg Co., also of Detroit. The bars are made in three types, the angle adjustable, the straight adjustable, and the removable block, to bore holes from ¾ to 15 in. in diameter. They are intended for both rough and finish boring and for reaming, and it is said that they can be furnished for all shapes and sizes of work, for use on a drill press, lathe, boring mill, or any other machine tool.



DETROIT ADJUSTABLE BORING BARS AND METHOD OF ADJUSTING

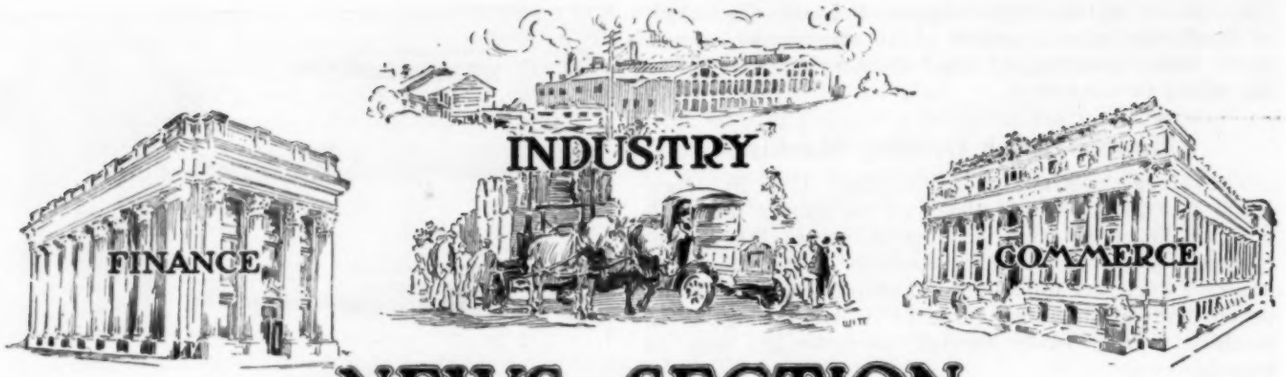
The phantom view shown in the accompanying illustration gives an idea of the construction of the angle type of bar. The position of the cutters is adjusted by means of the micrometer screw, and the cutters are then locked in place by the wedging action set up when turning the locking setscrew. It is said that the bars are very strong, as only a small section is cut out for the cutters and the operating mechanism. The cutters are heavy, so that the tool can be used for roughing work. For rough boring, dull cutters may be replaced with sharp ones and adjusted to size without removing the bar from the machine. A special grinding fixture can be provided for sharpening the cutters separate from the bar, if desired. The bar can thus be kept in use with one set of cutters while the other set is being sharpened.

Various combinations of standard cutters may be incorporated in the same bar for boring different diameters, counterboring and facing, all in one operation. The angle type of cutters is particularly adapted to facing and counterboring operations, because the cutters adjust forward when increasing the diameter. Continual setting out and grinding leaves the forward cutting edge in its original position, a necessary feature for some bars.

The bar shown at the top of the illustration is commonly used for drill press and boring machine work, and strip pilots are employed to obtain contact in the pilot bushing. The bar below it is intended for turret lathe use and holds a combination of cutters for boring and facing, as well as having a hardened pilot. The next view shows a bar for the boring of cast-iron and steel car wheels. The bottom view shows a line boring and reaming bar, having removable block-type cutters. The roughing blocks, finishing blocks and reamer blocks are interchangeable in the same slots, the changes being accomplished without removing the bar from the fixture. In addition to this, the blocks may be set to float ream, a play of 0.008 in. being allowed.

A Correction

In the article, "A Cover Curling Die," by S. A. McDonald in our issue of Sept. 22, an error was made in the illustration. In place of the capscrew under the washer *E*, there should have been shown the threaded end and part of the body of a stud for holding the rubber pad, lower washer and nut referred to in the text.



NEWS SECTION

Supply and Machinery Dealers to Meet in New York

L. H. Swind, chairman of the Machine Tool Section of the National Supply and Machinery Dealers' Association, has arranged a meeting of that body to be held at the Hotel Astor on Wednesday, Oct. 19.

The National Machine Tool Builders' Association is now in the process of selecting a speaker who will address the meeting.

Arrangements have been made for a discussion of the subject of "Terms of Payment" by dealers' customers, because of the tendency during the past six months to request unduly long terms of payment which, if the dealer gives, must be financed by him because of the short terms of the manufacturers.

The subject of trading in old machines at too high a price because of the present situation will also be considered with a view to improvement in the situation. The matter of the cost of securing orders under present condition of low demand and poor finances on the part of customers, as well as their desire to obtain all possible concessions of every character and description will be brought before the members at this time.

There will also be considered the matter of satisfying manufacturers with constructive sales efforts at this time of slow business when the manufacturer does not need to devote much of his time to questions of production, but turns all his attention to the sales department of his business at a time when sales are most difficult to make.

Massachusetts Courts Restrain Molders' Union

Pursuant to a decree of Judge Edward P. Pierce, of the Massachusetts Supreme Court, the Iron Molders' Union and its members are enjoined from any interference with the business or employees of the Springfield Foundry Co., Springfield, Mass. The decree finds that the defendants are in combination for an illegal purpose. They are specifically prohibited from carrying on a conspiracy to compel the company to conduct a closed shop. The defendants must not conspire to compel the company to abrogate the system of employing persons only under individual contract, must refrain from picketing the plant and from attempts to induce employees to break their contracts; also from the payment of strike benefits or other emoluments for the purpose of furthering the conspiracy. The decree is the outcome of equity proceedings brought last spring as a result of labor difficulties.

More Boxing and Crating Courses

Notice has just been received of another series of courses in boxing and crating at the Forest Products Laboratory, Madison, Wis., under the direction of the United States Department of Agriculture. These courses run for five and one-half days and will begin on Nov. 7, 1921; Jan. 9, March 6 and May 1, 1922.

The object of this course is to demonstrate the principles that underlie proper box and crate construction and to supply information which will be of assistance in developing economical containers that will deliver the contents in a satisfactory condition at a minimum cost.

The course lasts 5½ working days. Only a limited number are accepted in a class. This makes possible the exchange of ideas and experiences with men from different organizations and with the research men of the Laboratory.

Machinists' Union to Fight Navy Yard Wage Cut

Methods used by the Government in establishing wages were criticised by N. P. Alifas, president of District 44, International Association of Machinists, which comprises all machinists employed in the federal service, at the opening session of a six-day convention of the organization at Washington, D. C. Twenty-five delegates, representing all navy yards and arsenals and the Panama Canal Zone, were in attendance.

Mr. Alifas laid particular emphasis on the recent drastic pay reduction in the navy yards, and declared that some system must be adopted by the Government to set a fair wage scale for its employees. The present system, he said, is entirely unsatisfactory because the Government is following the "unfair" methods of private employers. He further declared that the policy of the Government as exemplified in the case of the navy yard wage cut is delaying the resumption of normal business activity by creating the impression that the low level of labor costs has not yet been reached.

Plans to have the navy yard wage award reopened, with a view to having the pay scale of the employees returned to the higher scale until the cost of living is "actually reduced," were discussed by the delegates.

If the administration authorities refuse to reopen the wage controversy it is the intention of the machinists' association to carry the fight to the capitol, and if the plan meets failure there, a nation-wide educational campaign will be launched to inform the people of the full meaning of the recent action of the Government in ordering the navy yard wage reduction.

Carriers Select November as Perfect Package Month

All trades and industries have been asked to co-operate in the perfect package movement to be inaugurated by the railroads, steamship lines and express companies in the United States and Canada, in November, which has been designated as "Perfect Package Month."

The purpose of the movement is to stimulate further public interest in good packing of shipments and to enable the carriers to improve the transportation service of the country. During November, an examination of all shipments sent by freight or express, will be conducted, to obtain information as to the best shipping methods carried on by the various trades and industries.

In every city and town, the railroad and express people will form campaign committees, to co-operate with local shippers' associations, in carrying out the plans announced for "Perfect Package Month." "Exception reports" will be made out for all faulty shipments discovered and these reports will be sent to the shippers' association for tabulation, to ascertain how high a percentage for "perfect packages," the shippers of that city have attained.

Comparisons of the records made by the various cities during November will be announced at the conclusion of the drive. The entire working forces of the railroad and express carriers, comprising some 2,000,000 men, will aid in the movement. The railroads, through the American Railway Association, composed of practically all of the railroads in the country, are pushing the campaign as a means of raising the standard of the service, while the express agents are also getting ready to interest shippers in the undertaking.

Program for Gear Manufacturers Meeting at Rochester

The semi-annual fall meeting of the American Gear Manufacturers Association will be held in the Powers Hotel, Rochester, N. Y., Oct. 13, 14 and 15.

Interesting reports will be offered by the various committees on standardization, and a program has been prepared including "Gear Tooth Wear," by S. O. White, chief engineer of the Warner Gear Co., Muncie, Indiana; "Duraluminum as a Material for Worm and Other Gearing," by R. W. Daniels, Bausch Machine Tool Co., Springfield, Mass.; "The Grinding of Gear Teeth and Its Future in the Industry," by J. F. Barr, secretary, the Gear Grinding Machine Co., Detroit, Michigan; "Tooth Forms," by E. W. Miller, chief engineer, Fellows Gear Shaper Co., Springfield, Vt.; and "First Hand Impressions of Europe," by E. S. Sawtelle, assistant general manager of the Tool Steel Gear and Pinion Co., who has recently returned from an extensive trip through Europe studying conditions there.

A feature of the meeting will be an inspection of the plant and luncheon of the representatives, as guests of the Gleason Works who will also be hosts at a clambake at Corbett's Glen.

The usual informal banquet will be held Oct. 14, in the Powers Hotel, with J. E. Gleason acting as toastmaster. Addresses will be delivered by the Hon. Arthur E. Sutherland, ex-judge of the Supreme Court of New York, on "Capital and Labor," and by Ernest Paviour, formerly President of the Rochester Advertising Club, whose subject will be "Advertising."

F. W. Sinram, of the Van Dorn & Dutton Co., Cleveland, is president of the Association, and F. D. Hamlin, of the Earle Gear and Machine Co., of Philadelphia, is secretary.

Lehigh Machine Co. Plant to Be Sold at Auction

By virtue of an order of the District Court of the United States for the Middle District of Pennsylvania made September 12, 1921, in the case of Lehigh Stove and Manufacturing Co., Complainant, vs. Lehigh Machine Co., defendant No. 296 October Term, 1920, there will be sold at public vendue or outcry on the premises the plant of the Lehigh Machine Co., in the Borough of Leighton, Carbon County, Pennsylvania, commencing on Thursday, Oct. 20, and continuing from day to day until the sale has been completed,

Besides the buildings and yard equipment, a great quantity of machinery will be sold. Lathes, grinding machines, shapers, drilling machines, tapping and chucking machines are included in the sale. William C. McConnell and Eugene N. Sanctuary are the receivers.

General Electric Reduces All Salaries

A reduction of 10 per cent in the salaries of all officers and employees of the General Electric Company has been announced by President E. W. Rice, Jr., in the following brief statement:

"In accordance with an order of the Board of Directors, a reduction of 10 per cent will be made as of Oct. 31, 1921, in the salaries of all officers and employees of the company.

"Heads of departments are requested to notify all those affected."

Publishers' Statement

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of American Machinist, published weekly at New York, N. Y., for Oct. 1, 1921.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared James H. McGraw, Jr., who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Co., Inc., Publishers of American Machinist, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Co., Inc., 10th Ave. at 36th St., New York, N. Y. Editor, K. H. Condit, 10th Ave. at 36th St., New York, N. Y. Managing Editor, L. C. Morrow, 10th Ave. at 36th St., New York, N. Y. Business Manager, Mason Britton, 10th Ave. at 36th St., New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) McGraw-Hill Co., Inc., 10th Ave. at 36th St., New York, N. Y. James H. McGraw, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, 10th Ave. at 36th St., New York, N. Y. John McGhie, 10th Ave. at 36th St., New York, N. Y. Fred Low, 10th Ave. at 36th St., New York, N. Y. Henry W. Blake, 10th Ave. at 36th St., New York, N. Y. Leonard D. Baldwin, 10th Ave. at 36th St., New York, N. Y. F. S. Weatherby, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, Trustee for Estate of John A. Hill, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, Trustee for Donald Baldwin, 10th Ave. at 36th St., New York, N. Y. Arthur J. Baldwin, Trustee for Franklin Baldwin, Grace Baldwin & Cynthia Haselton, 10th Ave. at 36th St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only).

JAMES H. McGRAW, JR.

Sworn to and subscribed before me this 20th day of September, 1921.

[Seal.] MARTIN J. WIEMER.

Notary Public Kings County Certificate No. 92. Certificate filed in New York County No. 202.

(My Commission expires March 30, 1922.)

American Cars in Belgium

Belgian cars are dominating the Belgian market, American-made cars being the hardest hit. Belgian cars have increased 45 per cent; French still hold their own, with an increase of about 40 per cent. The fluctuation in the market seems due to the demand for the lighter cars of French and Belgian make.

Black & Decker Establishes National Credit Service

The Black & Decker Manufacturing Co., Baltimore, Md., has recently put into effect what they term "The Black & Decker National Credit Service." The company's products are sold entirely through jobbers and the new service enables customers to buy through their regular jobber by paying 23 per cent of the regular price of the item in cash, and the balance in six equal monthly payments. Jobbers have been supplied with printed forms to be used for orders taken under this plan. These order forms are conditional sale agreements which make the item sold its own security until entirely paid for. The jobber forwards these orders to the company which discounts them for the jobber so that every sale made under this plan is in effect a cash sale for the jobber. The company shares fifty-fifty all responsibility with the jobber for the fulfillment of the sale agreement.

Metric Hearings in October

Hearings on Senator Ladd's metric system bill are expected to begin about the middle of October. The fixing of a definite date is awaiting the return of Senator McNary of Oregon, who as chairman of a subcommittee of the Committee on Manufactures will conduct the taking of testimony. Senator Ladd states that it is not the intention at this time to conduct extended hearings. An opportunity will be given to the proponents and to the opponents of the measure to make a concise presentation of the major points of their respective contentions. These preliminary statements will comprise a single record that is to be distributed widely with the idea of acquainting the public with the principal reasons for and against the adoption of the metric system as the single standard of weights and measures for the United States.

No Import Duty on Cars to Mexico

By an earlier decree of Jan. 7, 1919, automobiles had been exempted from import, and recent consular advise (Vice Consul Knox Alexander, San Luis Potosi, Aug. 22, 1921) confirms the understanding that there is no Mexican import duty collected now on an entire assembled automobile or on a shipment of all parts of an automobile, though unassembled. Separate automobile parts and accessories are, however, dutiable.

China Orders Coin Machinery in Philadelphia

The Fisher Machine Co. of Philadelphia has been awarded a contract for supplying coin-weighing machines and other mint equipment for the new mint of the Government of China.

The mint is being erected at Shanghai under the supervision of Clifford C. Hewitt, of Philadelphia, formerly an expert in mint building under the United States Treasury Department.

The Philadelphia-made machinery was chosen in competition with British and German companies. The order includes 120 coin-weighing machines, several coin selectors and other mint equipment. It will take the company eight months to fulfill the contract.

A. Leslie Lambert of Philadelphia, designer of the coin-weighing machines used in the United States mints, is to represent China as a proving expert. The machines are electrically operated and weigh 36,000 coins an hour within the refinement of one-sixteenth of a grain.

China is erecting the largest mint in the world. Its new coins are to be similar to the American silver dollar and fifty-cent piece.

Victor Bearings Co. in New Merger

Announcement has been made of the formation of the Victor Bearings Co., a corporation with a capital stock of $300,000 which will take over the properties of the Modern Die and Tool Co., Indianapolis, Ind., and will immediately start a program of increasing the productive capacity of the factory. W. L. Sandage, formerly president of the Modern Die and Tool Co., and president of the new company, has announced that work will begin at once on the erection of a $50,000 factory building in Indianapolis. Mr. Sandage said the plant will be moved into the new building within the next three months.

The officers of the company, besides Mr. Sandage, are R. G. Wolcott, vice-president, and H. A. Schlotzhauer, Jr., treasurer. Directors of the company in addition to the officers are H. W. James, Frank Olive, George Olive and Mrs. W. L. Sandage. The Modern Die and Tool Co. has been in existence sixteen years and in that time has been engaged principally in manufacturing Victor bearings for automobiles, trucks, racing cars and airplanes. The factory is now running day and night at full capacity, Mr. Sandage said. Mr. Sandage also owns the Automotive Bearings Co., of Los Angeles, Cal.

Exports of Metal Working Machinery Declining

Exports of metal working machinery during August established a new low record. The total value of all lathes, other machine tools, sharpening and grinding machines and all other types of metal working machinery was valued at $931,563. This is a decline of nearly one million dollars, as compared with August, of 1920, and is more than one million dollars under the monthly average for the first seven months of 1921. It is less than one-fifth the monthly average in 1919 and less than one-fourth the monthly average of 1920. Detailed figures for the month of August, 1921, compared with August, 1920, as given out by the Bureau of Foreign and Domestic Commerce, are as follows:

	Aug. 1920	Aug., 1921
Metal-working machinery:		
Lathes	$414,604	$51,569
Other machine tools	972,247	209,630
Sharpening and grinding machines	278,864	61,711
All other	1,242,778	608,653
Total metal-working machinery	2,908,493	931,563
Exported to:		
Belgium	117,892	8,704
France	259,789	365,403
Italy	144,695	5,026
Norway	6,543	8,637
Spain	30,069	7,026
Sweden	12,637	950
United Kingdom	883,882	67,453
Canada	527,622	70,663
Mexico	31,482	27,810
Cuba	87,570	16,988
Brazil	33,728	45,997
Chile	10,033	8,907
China	33,893	8,373
British India	127,881	119,064
Japan	290,541	51,481
Australia	17,420	13,357
Netherlands	.....	5,049
Argentina	.....	14,239
Dutch East Indies	.....	8,452
Other countries	292,816	77,984
Mining machinery:		
Oil well machinery	463,623	710,915
All other machinery	608,222	495,653
Pumps and pumping machinery	959,113	484,480
Road-making machinery	44,673	48,709
Imports:		
Machine tools	126,330	16,101

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The attention of American business is again focused upon Washington. Much is expected from the unemployment conference and Congress. Disappointment will probably follow the action taken. The use of a "Treasury tonic" as a cure for the unemployment evil has been wisely inhibited by President Harding, and the conference can hardly do more than resolve and recommend. As to Congress it is impossible to pass a tax bill that will please any very large proportion of those who are separated from their money. It is, however, reassuring to learn from Mr. Hoover that the unemployment has been exaggerated and that not more than 3,500,000 persons are out of work. The conference will probably hasten the automatic readjustment of our industrial machinery by which they will be provided with jobs. The real trouble is the overgrowth of our city population and unemployment will probably be a recurring phenomenon until people are driven back to the country. In this aspect it is not an unmixed evil.

But as dissatisfaction with Washington is normal in the United States, it is hardly pessimistic to anticipate it and the outlook otherwise is quite as cheerful as it was last week.

If optimism in the index could make prosperity we should have nothing to complain of for the newspapers are still unanimous in proclaiming the advent of better times.

Of the facts as far as they are ascertainable it may be said that in the main they support the optimistic predictions. The prices of some articles are up and others have declined, but the volume of trade is increasing. Bank clearings show this. So do the "individual debits" reported by the Federal Reserve Banks. The dollar value of the August sales in the department stores of the New York Federal Reserve district is only 5.2 per cent below last year, whereas prices show an average decline of fully 30 per cent, and the number of individual sales in August was 18.2 per cent greater than in August 1920. The great mail order houses report a better business and the savings banks of the State of New York opened 80,000 new accounts and increased their deposits by about $252,000,000, or nearly 10 per cent, during the year ending June 30, 1921.

This accumulation may partially explain the growing ease of money and the advance in Liberty Bonds which have continued to move upward during the week and are now an average of nearly 5 per cent over the low prices of the year. When it is considered that it means an appreciation of about 1¼ billion dollars in the value of the issues outstanding some idea of its significance may be had. Other bond issues have been correspondingly strong.

The Government has now sold nearly $100,000,000 of railroad equipment trust notes it held on a 6 per cent basis, and they are being resold to the public at a price which yields the ultimate buyer about 5.80 per cent. There are about $200,000,000 more of these obligations in the Treasury vaults. If they are disposed of the War Finance Corporation will be in a position to give the railroads nearly all the financial help they require.

Mr. Meyer deserves commendation for the skill with which he has managed the financial operations incident to this liquidation. Railroad net earnings are meantime improving. Traffic is increasing and in the stock market railroad shares are at last commencing to reflect the better outlook for the transportation industry. Enthusiasm has been somewhat repressed by the threats of labor trouble and the attitude of the Pennsylvania Railroad toward the Labor Board, but a strike seems improbable and years of peaceful litigation will probably be necessary in order to determine whether the Labor Board can enforce its decrees or not. While the question is in the courts the railroads will be called upon to determine whether they will accept Professor Ripley's plan for railroad consolidation which was formally submitted for their consideration by the Interstate Commerce Commission last week.

It contemplates the creation of nineteen super systems and the complete remaking of the American railroad map. Its acceptance is not compulsory but the Interstate Commerce Commission intimates that Government ownership may follow if it or some other similar plan is not ultimately accepted.

Had the speculative imagination been normally responsive to the mergers suggested and the increase in earning power which will follow a sharp advance in many railroad stocks would no doubt have followed the promulgation of the plan. It may be that it will be made the basis of an upward movement in railway shares when the market "wakes up."

The conditions which favor a speculative revival are all present. The bond market has been swept clean. Money is daily growing more plentiful. The weekly statement of the Federal Reserve Banks shows a further gain of $14,000,000 in the gold reserves and a reserve ratio of 69 per cent as compared with 68.7 last week. The continued accumulation of gold in the United States is coming to be the subject of general discussion and many economists are now predicting that it may bring about the secondary inflation that I have for some time foreseen.

Of the commodity markets not much need be said. Cotton waits upon the Government report with a confidence that has been reinforced by the action of some Japanese merchants who took up the October tenders in New York. The dry goods market follows reluctantly in the footsteps of the raw material. Coffee is distinctly firmer and the bullish predictions to which I alluded last week seem likely to be realized. Wheat and corn have been perversely weak, disappointing the experts who explain their error of judgment upon the theory that the phenomenal exports have been "over discounted." Rubber is higher. So are hides. Sugar is lower because the Cuban Commission has reduced its selling price. Silk is up again, on a rumored failure of the autumn cocoon crop. Copper is higher on large trade buying, one sale of 5,000,000 lb. at 12¾ cents being reported. The outlook in the steel industry is much brighter and prices are higher all along the line. Mr. Lamont has started on his visit to Mexico City and from now on a quickened American interest in Mexican investments is to be expected.

A trade revival in East India is reported concurrently with a further advance of 2d. in silver which sold at 43¾d. per ounce in London last week. Lloyd George has finally agreed to a conference with the Irish at which the ancient feud will probably be settled. The foreign outlook is generally more auspicious except for the decline in marks which sold as low as 70 cents per 100 on Wednesday last. Their value is now negligible and as the outstanding circulation in Germany has been increased by a further billion and a half during the week, being now 82,178,365,000 marks, there seems to but little chance of any permanent recovery.

This is the only fly in the ointment of optimism and it is not at present seriously regarded in the United States as it is offset by so many evidences of real domestic prosperity that people refuse to be alarmed. This is a condition that makes for "better times."

Edgar T. Ward, Steel Merchant, Dead

Edgar Temple Ward of West Newton, Mass., a native of Sheffield, England, and long a steel merchant in that city and in Boston, died in his seventy-ninth year at his summer home in Needham, Mass., on Sept. 28.

As a young man he engaged in the steel business in Sheffield, and came to the United States about 1880. Two years after his arrival in this country, Mr. Ward became American agent for the establishment of Seebohm & Dieckstha1, steel manufacturers of Sheffield. Later he was a founder of the Union Twist Drill Co., of Athol, Mass., now a $6,000,000 corporation. He was treasurer of that concern for ten years, and resigned as a director only last year.

In March, 1894, he founded the firm of Ward & Nash Co. of Chicago and Boston. George Nash, a well known steel and iron merchant of Chicago, was Mr. Ward's partner in this combination, which partnership was dissolved in 1899, the latter continuing as American representative for Seebohm & Dieckstha1. The same year the business house of Edgar T. Ward & Sons, steel merchants, was formed. Mr. Ward continued active until his retirement in 1912, after which the firm continued under that name until 1918, when the business was reorganized as the Edgar T. Ward Sons Co.

Mr. Ward's three sons, John, Edgar and Asline, are engaged in the steel business under the firm name of Edgar T. Ward & Sons.

H. P. Parrock Resigns

H. P. Parrock, for many years general manager of the Lumen Bearings Co., in charge of the Buffalo, N. Y., and Youngstown, Ohio, plants, has resigned. He will engage in professional engineering work, specializing in the design, construction and operation of foundries.

Mr. Parrock has had extended experience in the mechanical engineering field. At different times he has been superintendent of the foundry departments of the Penn Steel Co. and the Youngstown Foundry and Machine Co. He is also a director in these companies. Mr. Parrock's offices will be at 164 Lancaster Ave., Buffalo, N. Y.

Fordney Claims Increased Revenue Under American Valuation Plan

Speaking before the national conference of the State Manufacturers Association in the Congress Hotel, Chicago, Ill., on Sept. 27, Congressman Joseph W. Fordney declared that the American Valuation Plan, a feature of his impending tariff bill, will increase the government revenue on imports, protect American industries and exert a beneficial influence on the unemployment situation.

Under his plan the duty on imported articles will be based on the American value of the goods, instead of the foreign valuation as is the present practice. Duties on imports will not fluctuate with the depreciation of foreign currency and as valuation will be based on the American gold dollar.

Walter Camp, president of the American Valuation Association, addressed the conference on "Exchange and American Valuation." He pointed out that Canada is charging seven and one-half times the duty figured on foreign valuation of German goods. This makes it possible for them to sell Canadian goods in the Canadian market in competition with German merchandise. He stated that the unemployment records showed twenty-nine per cent in the United States compared to four in Germany, and whereas German currency has depreciated to one-thirtieth of its former value, living costs in Germany have only increased seven times. This makes it possible for German manufacturers to pay good wages and still sell their goods at a price below the American production cost.

Other speakers were William Butterworth, president of the conference; Willis F. Wakeman, American Protective Tariff League, of New York; E. B. Leigh, president, Chicago Railway Equipment Co.; Hon. Ira C. Copley, member of the Ways and Means Committee of the Senate; M. Felton, president of the Chicago Great Western Railroad Co.; J. B. Reynolds, of the Treasury Department, Washington, D. C.; A. C. Davis, Gurney Ball Bearing Co., Jamestown, N. Y.; Clarence E. Bement, president Novo Engine Co., Lansing, Mich.; W. L. Allen, Laclede Steel Co., St. Louis.

Resolutions were adopted by the conference endorsing the American valuation plan and the Fordney Tariff Bill.

Practical Suggestions from the Unemployment Conference —Four Million Out of Work—Suggest Emergency Commission To Act as Employment Agency

Those who are responsible for the providing of proper machinery by which the Unemployment Conference was able to get to work promptly, are to be congratulated. Credit for most of this, we understand, should go to Herbert Hoover, who not only provided clerks, stenographers, etc., but had a mass of information on the subject of unemployment so as to be readily available for the various committees.

The following summary of its recommendations for an emergency program for immediate adoption and prosecution, deserves the careful study of every thoughtful person who desires to be a good citizen:

(1) The conference finds that there are about 4,000,000 unemployed, as shown by payrolls, and there is a much greater number dependent upon them. There has been an improvement, but pending general trade revival this crisis in unemployment can not be met without definite and positive organization of the country.

(2) The problem of meeting the emergency of unemployment is primarily a community problem. The responsibility for leadership is with the Mayor and should be immediately assumed by him.

(3) The basis of organization should be an Emergency Committee representing the various elements in the community. This committee should develop and carry through a community plan for meeting the emergency, using existing agencies and local groups as far as practicable. One immediate step should be to co-ordinate and establish efficient public employment agencies and to register all those desiring work. It should co-ordinate the work of the various charitable institutions. Registration for relief should be entirely separate from that for employment.

(4) The personnel of the employment agencies should be selected with consideration to fitness only, and should be directed to find the right job for the right man and should actively canvass and organize the community for opportunities for employment. The registry for employment should be surrounded with safeguards and should give priority in employment to residents. Employers should give preference to the emergency employment agencies.

(5) The Emergency Committee should regularly publish the numbers dependent upon them for employment and relief that the community may be apprised of its responsibility. Begging and un-coordinated solicitation of funds should be prevented.

(6) Private houses, hotels, offices, etc., can contribute to the situation by doing their repairs, cleaning, and alterations during the winter instead of waiting until spring, when employment will be more plentiful.

(7) Public construction is better than relief. The municipalities should expand their school, street, sewage, repair work and public buildings to the fullest possible volume compatible with the existing circumstances. That existing circumstances are favorable is indicated by the fact that over $700,000,000 of municipal bonds, the largest amount in history, have been sold in 1921. Of these, $106,000,000 were sold by 333 municipalities in August. Municipalities should give short time employment the same as other employers.

(8) The Governor should unite all State agencies for support of the mayors and, as the superior officer, should insist upon the responsibility of city officials; should do everything compatible with circumstances in expedition of construction of roads, State buildings, etc.

(9) The Federal authorities, including the Federal Reserve Banks, should expedite the construction of public buildings and public works covered by existing appropriations.

(10) A Congressional appropriation for roads, together with State appropriations amounting to many tens of millions of dollars already made in expectation of and dependence on Federal aid, would make available a large amount of employment. The conference under existing circumstances, notwithstanding various opinions as to the character of the legislation and the necessity for economy, recommends congressional action at the present session in order that work may go forward.

(11) The greatest area for immediate relief of unemployment is in the construction industry, which has been artificially restricted during and since the war. We are short more than a million homes; all kinds of building and construction are far behind national necessity. The Senate Committee on Reconstruction and Production, in March of this year, estimated the total construction shortage in the country at between ten and twenty billion dollars. Considering all branches of the construction industries more than two million people could be employed if construction were resumed. Undue cost and malignant combinations have made proper expansion impossible and contributed largely to this unemployment situation. In some places these matters have been cleaned up. In other places they have not and are an affront to public decency. In some places these things have not existed. In others costs have been adjusted.

Some materials have been reduced in prices as much as can be expected. Where conditions have been righted, construction should proceed, but there is still a need of community action in provision of capital on terms that will encourage home building. Where the costs are still above the other economic levels of the community there should be searching inquiry and action in the situation. We recommend that the governors summon representative committees, with the co-operation of the mayors or otherwise as they may determine, to (a) determine facts; (b) to organize community action in securing adjustments in cost, including removal of freight discriminations, and clean out campaigns against combinations, restrictions of effort, and unsound practices where they exist to the end that building may be fully resumed.

(12) Manufacturers can contribute to relieve the present acute unemployment situation by:

(a) Part time work, through reduced time or rotation of jobs.

(b) As far as possible, manufacturing for stock.

(c) Taking advantage of the present opportunity to do as much plant construction, repairs, and cleaning up as is possible, with the consequent transfer of many employees to other than their regular work.

(d) Reduction of the number of hours of labor per day.

(e) The reduction of the work week to a lower number of days during the present period of industrial depression.

(f) That employees and employers co-operate in putting these recommendations into effect. A large number of employers have already, in whole or in part, inaugurated the recommendations herein set forth, and for this they are to be commended, and it is earnestly urged upon those employers who have not done so to put same into use, wherever practicable, at the earliest possible opportunity.

(g) Specific methods for solution of our economic problems will be effective only in so far as they are applied in a spirit of patriotic patience on the part of all our people.

During the period of drastic economic readjustment, through which we are now passing, the continued efforts of anyone to profit beyond the requirements of safe business practice or economic consistency should be condemned. One of the important obstacles to a resumption of normal business activity will be removed as prices reach replacement values in terms of efficient producing and distributing cost plus reasonable profit.

We, therefore, strongly urge all manufacturers and wholesalers who may not yet have adopted this policy to do so. But it is essential to the success of these measures when put into effect that retail prices shall promptly and fairly reflect the price adjustment of the producer, manufacturer, and the wholesaler.

When these principles have been recognized and the recommendations complied with, we are confident that the public will increase their purchases, thereby increasing the operations of the mills, factories and transportation companies, and consequently reducing the number of unemployed.

The Electric Foundry and Engineering Co. has been incorporated at Philadelphia, Pa., with a capital stock of $100,000 to manufacture metal castings and machinery.

The National Pump Co., Philadelphia, Pa., has been incorporated with a capital of $250,000. Pumps and pumping machinery will be the principal products.

The "Superpower" report made under the direction of the U. S. Geological Survey, is now in proof form and was released for publication Oct. 1.

Business Items

T. A. Jones has been elected president of the W. A. Jones Foundry & Machine Co., Chicago., Ill., to take the place of William A. Jones, deceased. Mr. Jones has been for many years associated with the company as secretary and treasurer. Other officers elected were W. T. Jones, vice-president and treasurer; J. A. Sizer, secretary; G. W. Page, assistant secretary. The general policy of the company is in no way altered by these changes and W. T. Jones continues as general manager in addition to his new position as vice-president and treasurer.

Reorganization of the Mercer Motors Co., Trenton, N. J., has been completed by the private sale of $2,000,000 in 7 per cent four-year notes, and $500,000 in twenty-year first mortgage bonds. In addition, 100,000 shares of voting trust certificates have been disposed of, making 200,000 shares of these certificates outstanding. The corporation's balance sheet shows current assets of $2,265,767 and current liabilities of only $334,107.

The Garden City Spring Co., maker of the Stanley self-oiling spring, has opened a branch factory at Harrisburg, Pa. T. B. Wildermuth, president of the Front-Market Motor Co., will be general manager of the new plant.

Employees of the Scranton Bolt and Nut Co., Scranton, Pa., some of whom declined to accept a cut in wages and quit, have voted to return and the plant is again in full operation.

The Crane Company has announced that it will soon transfer the manufacture of its brass valves and other products to the plant in Chicago, Ill., leaving the Bridgeport, Conn., plant free to handle the iron production. The Bridgeport plant recently went on a four-day-a-week schedule, instead of three days.

Removal of the plant and equipment of the Stevenson Gear Co., Indianapolis, Ind., from its old quarters to its new factory building at Eleventh St. and Cornell Avenue, has been completed and the company is now in position to resume active manufacture of its product—the Stevenson multiple gear shaper.

The Lyons Manufacturing Co., Providence, R. I., has recently taken over the business of the Metal Products Co., 195 Eddy St., Providence. E. A. Willemine, formerly with the Metal Products Co., has been made superintendent of the metal products department of the Lyons Company.

The Silverman Manufacturing Co. of Providence, R. I., manufacturer of metal goods, etc., has recently removed from 415 Richmond St., to 40 Bassett St., that city.

The Whitlock Coil Pipe Co., of West Hartford, Conn., coil pipe manufacturers, has recently added $50,000 to the capital stock of the company.

The Universal Shuttle Spring Co. of Fall River, Mass., has just been organized and incorporated with a capital stock of $99,000, to manufacture shuttle springs, etc. The president is Isaie Laplante; treasurer, Louis A. Cadoret.

The Safe Auto Lock Co. of Boston, Mass., has recently been organized and incorporated under the laws of the Commonwealth of Massachusetts, to manufacture automobile locks, etc. The capital of the company is $150,000, and the officials are Stanley B. Andrews, president, and Charles F. A. Smith, treasurer.

The Bausch Machine Tool Co., Springfield, Mass., has placed a $1,000,000 mortgage on its property with the State Street Trust Co., Boston. The transaction is in the form of 15-year, 8 per cent, sinking fund, convertible first gold mortgage bonds. Recently the company bought the plant of the Huron Metals Co., adjacent, which it had previously operated under a lease.

The Air Compressor and Equipment Co. has been incorporated at Portland, Ore. Air compressors will be manufactured and assembled. Guy S. Malcolm, George Larrabe and W. E. Thomas are directors.

The Curran-Devitt Motor Co. has been incorporated at Philadelphia, Pa. Capital stock is $350,000.

The Hendee Manufacturing Co., manufacturers of motorcycles and bicycles, Springfield, Mass., has been incorporated to do business in Illinois. The capital stock is $12,500,000, of which $191,625 is to be employed in Illinois. It is said that this is done to make legal, under Illinois laws, the company's sales office at 1229 So. Wabash Ave., Chicago.

The Scholtz Tool Gear and Machine Works, Inc., Waterloo, Iowa, has recently enlarged its machinery equipment by adding $10,000 worth of new machinery. The total machinery equipment is now valued at $30,000. O. A. Scholtz, manager, has recently invented an "auto ambulance" for hauling broken down cars to repair shops and it will be manufactured and marketed by his factory.

The Stein Metal Co., Springfield, Mass., has moved its plant from 54 Taylor St. to 291 Chestnut St.

Personals

Saunders Jones, vice-president for several years of the Atlanta Stove Works, of Atlanta, Ga., resigned his position recently and left for Dallas, Tex., where he will be connected with the Dallas branch of the White Company, manufacturers of motor trucks.

The W. A. Jones Foundry & Machine Co. announces the appointment of Robert B. Moir as manager of the New York branch. He will assume his new duties immediately, making headquarters at the present sales office and transmission warehouse of the company at 20 Murray St. Mr. Moir has been actively connected with the home office and factory for a number of years and is well qualified to assist in power transmission and general engineering problems.

Count Frederick Moltke, of Denmark, chairman of the Danish Steel Industries, Ltd., arrived in this country from Copenhagen on Sept. 27. He said he had come with the expectation of business talks with a number of American industrial heads, particularly those in the steel industry. In Denmark, he said, the steel industry had practically closed down, with more than 60,000 out of employment because of the dislocation of trade with Russia. Resumption of business with Russia, he said, was something for the far distant future to contemplate.

Obituary

Alexander Mason Gibbes, president of the Gibbes Machinery Co., of Columbia, S. C., and a prominent member of the Southern Metal Trades Association, died recently at Columbia, at the age of 44 years. Mr. Gibbes visited his office as usual the day of his death and was apparently in the best of health. He died suddenly while sitting in a chair before his desk.

Henry J. Kimman, manager of the Cleveland plant of the Chicago Pneumatic Tool Co., died in Cleveland, Ohio, on Sept. 7. He was born in Haarlem, Holland, in 1863, and emigrated to America with his parents and settled in Chicago in 1870. Being of a mechanical trend of mind he served his time with the Adams-Westlake Co. and other manufacturing concerns in Chicago and the West. In the manufacture of air drills he became associated with E. N. Hurley and they formed the Standard Pneumatic Tool Co. in 1898. Later he became associated with the Chicago Pneumatic Tool Co. in the consolidation of pneumatic tool interests. He was appointed manager of the Cleveland plant of the Chicago company and remained in active charge of the plant until his death.

Alexander Fleck, president of the Alexander Fleck, Ltd., Vulcan Iron Works, Ottawa, Canada, died at his home there on Sept. 22. He was 54 years old. He was prominent in the foundry and machine industry in Canada and the United States.

Allan Ransome, for many years identified with the machine-tool trade in this country, died in San Francisco on Sept. 21. He was 61 years old. At one time he was connected with the Lodge & Davis Machine Tool Co., and also with the Prentiss Tool Company.

Book Reviews

Drawing Room Practice. By Frank A. Stanley, editor *Western Machinery World* and Consulting Mechanical Engineer. Two hundred fifty-three 6x9-in. pages, 487 illustrations. Published by the McGraw-Hill Book Co. Inc., 370 Seventh Ave., New York City.

A volume which deals with the making of drawings, from the simplest details of mechanism to complete assembly. The material has been drawn from experience gained in a number of the leading drafting rooms of both America and Europe, and in class work in connection with the instruction of students, machinists and toolmakers. The chapters on the laying out of jigs and fixtures, punches and dies and other special tools are as comprehensive as the space allotted will permit of. This and the chapter on limit dimensions or drawings should be of benefit to many of the older draftsmen as well as those of more limited experience over the drawing board. Following are the chapter headings, which will give an idea of the scope of the work: Drawing Instruments and Their Uses; Projection; Practical Applications of the Principles of Projection; Development of Surfaces; Intersections; The Helix and Its Applications; Screw Threads in Their Conventional Forms; Showing Detail Parts—Sections; Parts and Sections in Assembly Drawings; Working Drawings; Working Drawings of Small and Medium Sized Parts; Tool Drawings; Limit Dimensions or Drawings; Isometric and Oblique Drawings; Shop Sketches.

The Working of Steel: By Fred H. Colvin and K. A. Juthe. Two hundred thirty-seven 6 x 9-in. pages, green cloth boards. Many illustrations and tables. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City.

This book is a treatise on annealing, heat treating and hardening of carbon and alloy steels. It supplies information from the authors' experience and from other reliable sources as to the most approved methods of working the various kinds of steel now in commercial use, including low carbon, high carbon and alloy steels of various kinds. The automotive industry has been drawn upon freely as has practice in government arsenals on steels used in firearms. There is included information on the making of different steels.

Chapter headings are: Steel Making; Composition and Properties of Steels; Alloys and their Effect Upon Steel; Application of Liberty Engine Materials to the Automobile Industry; The Forging of Steels; Annealing; Case-hardening or Surface Carburizing; Heat-treatment of Steel; Hardening Carbon Steel for Tools; High-Speed Steels; Furnaces; Pyrometry and Pyrometers.

The book is well and carefully written. The authors have expended much time and work in preparing this volume, which will be found of value to all who use steel.

The Elements of Specification Writing. By Richard Shelton Kirby, C. E., assistant professor in the Sheffield Scientific School of Yale University. Second edition, revised. One hundred fifty-three 6x9-in. pages. Published by John Wiley & Sons, Inc., New York City.

In this edition the manuscript has been revised for the purpose of widening the field of usefulness of the book for those outside the civil engineering profession; to emphasize the practical connection between the content and phrasing of specification clauses and their application to working conditions, and to bring the book up to date. The increased number of concrete illustrations and the questions for discussion following certain chapters are intended to contribute to more effective teaching. Much new material has been added and chapters I and II have been largely rewritten. The chapter headings in the order of presentation follow: Introduction; Contract and Bond; Advertisement (or Notice to Contractors) and Information for Bidders; Proposal; The Composition of Specifications; General Clauses—Specifications and Plans; General Clauses—The Engineer During Construction; General Clauses—The Contractor and His Workmen; General Clauses—The Contractor's Miscellaneous Responsibilities; General Clauses—Progress of Work; General Clauses—Terms of Payment; Specific Clauses: Outlines of Specific Clauses.

Official report of the Eighth National Foreign Trade Convention. Six hundred and twenty-eight pages, 6 x 9 in., published by the National Foreign Trade Convention Headquarters, India House, New York City.

This is a stenographic report of proceedings, discussions and speeches at the eleventh group session and the addresses of the general sessions, together with a list of the delegates present, the organizations and companies represented, and the personnel of the convention. This convention was held in Cleveland, May 4 to 7, inclusive, and, as may be imagined, covered a wide variety of the different phases of foreign trade. It is obviously impossible to give an adequate review of proceedings of this kind, as this would require copious extracts from the addresses delivered at the various sessions. All who are interested in foreign trade prospects, will do well to study the various suggestions made, not omitting the addresses of Paul H. Cromelin and Rowland Rogers, pointing out the value of the motion picture in this connection. Pictures speak a universal language and cannot be misinterpreted nearly so readily as translations into a foreign language.

Foreign Commerce and Navigation of the United States, 1920: Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. Copies may be purchased from Superintendent of Documents, Government Printing Office, Washington, D. C., at $1.25 per copy.

A voluminous collection of statistics covering the export and import trades of the United States with foreign countries for the calendar year 1920. This data is mostly in the form of tables which are grouped according to kind of merchandise, use and degree of manufacture. Two tables summarizing the number and tonnage of vessels entered and cleared in the foreign trade are also included.

Personal Selling. By Wesley A. Stanger. Twelve 5 x 8-in. paper covered pamphlets of from 18 to 30 pages each, with a paper container for the group. Published by the Biddle Publishing Co., 19 W. 44th St., New York City.

The pamphlets take up: Personality of the Salesman; Meeting Competition; Requirements for Success; Meeting Objections; Resistance; Solicitation; Prospects; Price; Closing the Deal; Compensation, etc. Each treatise is concluded by a list of questions which the careful reader should be able to answer to his own satisfaction.

This set of pamphlets will be of benefit to salesmanager, salesman and prospective salesman. The pertinent points in selling are listed and discussed in a competent and thorough manner. The pamphlet form makes it possible to study any one subject any time without carrying a large volume.

Forthcoming Meetings

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind., on Oct. 10 to 13, inclusive. L. F. Boffey, 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

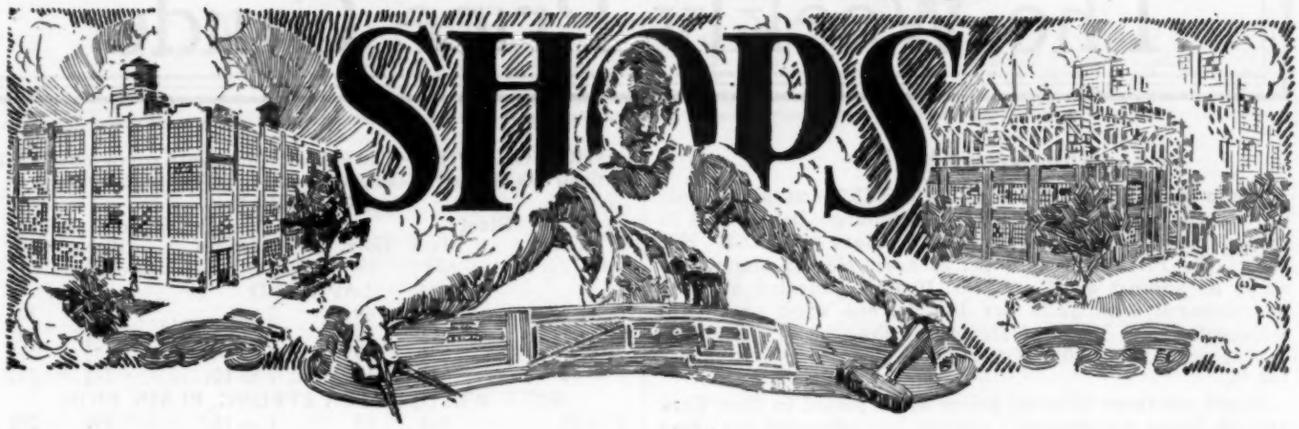
There will be a meeting of the Machine Tool Section of the National Supply and Machinery Dealers' Association in the Hotel Astor, New York City, on Wednesday, Oct. 19, at ten o'clock in the morning. Thomas Fernley, 505 Arch St., Philadelphia, Pa., is secretary.

The annual convention of the Industrial Relations Association, of America, will be held in the Waldorf-Astoria Hotel, New York City, on Nov. 1, 2, 3 and 4.

The National Conference of the Industrial Cost Association will be held at Pittsburgh, Pa., on Nov. 2, 3 and 4.

The third annual convention and exhibition of the American Gas Association will be held in the Congress and Auditorium Hotels, Chicago, Ill., on Nov. 7 to 12.

NEW *and* ENLARGED



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Norwich—The United Metal Mfg. Co., Inc., R. S. Chisolm, Pres.—one planer with 5 ft. bed and 2 No. 4 Warner & Swasey turret lathes.

Mass., Adams—H. C. Kaiser, Main St.—equipment for auto repair shop.

Mass., Dedham—The Dedham Motor Mart, Eastern Ave.—equipment for garage.

Mass., Holyoke—The New England Tire & Rubber Co., South Main St., E. Kerns, Vice-Pres.—small machine tools including engine lathe, power drill press, etc.

Vt., Wallingford—The Wallingford Mfg. Co., manufacturer of hand tools for farm and garden—No. 0 Stiles power punching press, similar to Bliss, and one riveting or rivet spinning machine.

N. J., Mt. Holly—W. A. Jones, Washington and King Sts.—tools for garage and service station.

N. Y., New York—The Cornesh Wire Co., 30 Church St.—one 11 in. x 5 ft. lathe, complete with regular equipment including compound rest, large and small face plates and countershaft with 12½ in. swing over bed.

Pa., Philadelphia—J. Meyer Glenwood Tile Co., 1944 North 20th St.—tools for repair shop and garage.

Pa., Williamsport—H. A Sterner, Secy. School Dist., 229 West 3d St., will receive bids until Oct. 19 for 3 motor driven engine lathes, 11 x 36 in. between centers.

La., New Orleans—The Estate of R. G. Holzer, 317-329 Burgundy St. (manufacturers and sheet metal workers), J. E. V. Holzer, Asst. Sales Mgr.—one 10 ft. 6 in. G. A. Ohl power press brake ¼ equal; Ives & Lamberson 2¼ in. x 26 in. turrent lathe, (used machines, late models).

S. C., Greenville—Harris-Brockman Mfg., Co., Inc., manufacturers of pumps, etc., J. O. Brockman, Secy.—one 6¼ in. hollow spindle turret lathe, vertical turret drilling machine, special tools to be made to order. Would like to get in touch with die casting works.

Va., Richmond — The Stewart Products Service Station, 1615 West Broad St.—calibrating machine (new or used), drill press and small lathe.

Ill., Chicago—Hess Warming & Ventilating Co., 1219 South Western Ave.—one No. 4 punch press.

Ill., Galesburg—The Rowe Mfg. Co., Holton and West 3rd Sts.—one spot welding machine.

O., Buffton—Burns Products Co., W. H. Wallace, Purch. Agt.—shop equipment for machinery manufacture.

O., Columbus—Lowe Bros. Machine and Eng. Co., 200 West Mound St., W. D. Lowe, Purch. Agt.—one 20 in. press without back gears, and a motor driven emory stand.

Wis., Milwaukee—W. A. McElroy, 656 Astor St.—one drill press 15 in table, one small lathe, one bench drill press, one arbor press, one tool post grinder and one 10 in. emery wheel.

Wis., Milwaukee—The Natl. Fdry. Co., 24th Ave. and Park St.—punch press and tinners brake.

Wis., Milwaukee—The Smith Eng. Wks., 1154 32nd St., C. F. Smith, Pres.—drill presses.

Wis., Milwaukee—The Standard Sheet Metal Wks., 1184 24th St., J. Madis, Purch. Agt.—8 ft. brake, also square shear with 8 ft. opening.

Mo., Joplin—Rogers Fdry. Co., 11th and Pearl Sts.—tools for machine shop.

Tex., Wichita Falls — Superintendent of Missouri, Kansas & Tex R.R. Co., Wichita Falls—machinery and lathes, drills, etc., for car shops.

Ore., Klamath Falls—The Klamath Iron & Steel Wks., Inc.—catalogues for founders and machinists.

Que., Montreal—Bramsons Auto Service, Ltd., Phillips Sq., L. Bramson, Purch. Agt.—machinery for proposed auto repair shop.

Que., Montreal—L. J. Phaneuf, 201a Christopher Columbus St.—equipment for garage and auto repair shop.

C. A., Honduras, San Pedro—J. E. Barrett—one 13 in. lathe, 8 in. swing over bed and a 15 in. lathe.

Mass., West Springfield (Springfield P. O.)—P. Fossa, New Bridge St.—machinery for making ice cream, shafting, hangers, etc.

N. Y., Buffalo—Planing Mill, 15 Layer Ave., J. M. Holland, Purch. Agt.—one 12 in. jointer.

N. Y., Poughkeepsie—H. C. Gaul, Dir. of Industrial Arts High School—Universal woodworker.

Pa., Mt. Carmel—The Shamokin & Mt. Carmel Ry. Co.—One band saw machine not less than 36 in. One jointer not less than 12 in. One Universal wood machine.

Pa., Philadelphia—F. W. Tunnell & Co., 15 North 5th St.—machinery for proposed fertilizer plant.

Pa., Philadelphia—C. Wacker Co., 1304 West Cumberland St.—wood-working machinery.

S. C., Florence—The Florence Gas Co., S. W. Brown, Vice Pres. and Mgr.—Steam driven compressor for artificial gas requiring a maximum pressure of 40 lbs. and having a capacity of 15,000 ft. per hour.

S. C., Lena—H. L. Lawton—two saw trimmers, 16 ft. or over, (used if in good condition).

Va., Damascus—The Damascus Lumber Co., C. W. Bondurant, Purch. Agt.—band re-saw, niggers, kickers, edger, carriage, trimmer, live rolls and all equipment for band mill, including engine large enough to run entire equipment.

O., Columbus—Madden-Atkinson Auto Co., 399-401 East Main St., R. P. Atkinson, Purch. Agt.—several air compressors.

Wis., Fond-du-Lac—Latex Tire & Rubber Co., East Scott St.—one tubing machine, two rubber mills and two building machines.

Wis., Merrill—The Merrill Wood Products Co.—woodworking machinery to manufacture boxes.

Wis., Milwaukee—C. N. Caspar Co., 454 East Water St.—one medium size steel paper baling machine.

Wis., Milwaukee—The Holeproof Hosiery Co., 41 4th St.—knitting machines.

Wis., Milwaukee—The Moon Beverage Co., 207 Pereless Bldg., T. W. Webb, Purch. Agt.—capping machines, fillers, etc.

Wis., Milwaukee—The National Distilling Co., 27th St. and St. Paul Ave.—distillery apparatus.

Wis., Nelsonville—H. J. Kaukrud—machinery for proposed saw mill.

Wis., Racine—Horlicks Malted Milk Co., Holicksville, W. Horlick, Purch. Agt.—barley separators and graders, malt cleaning machines and conveyors.

Cal., Los Angeles — Keeler-Comey C., c/o G. W. Eldredge, Archt., 226 Pacific Finance Bldg.—machinery for making ice cream.

Que. Montreal—W. Taylor, 2454 Chalvt St.—machinery and equipment for foundry.

Metal Working Shops

NEW ENGLAND STATES

Conn., Putnam—The New York, New Haven & Hartford R.R., New Haven, has awarded the contract for the construction of a 1 story, 45 x 170 ft. roundhouse at the freight yard here.

Mass., Adams—H. C. Kaiser, Main St., will soon award the contract for the construction of a 1 story, 70 x 100 ft garage and service station on Main St. Estimated cost, $40,000. Private plans.

Mass., Dedham—The Dedham Motor Mart, Eastern Ave., will soon award the contract for the construction of a 1 story, 80 x 130 ft. garage on Eastern St. Estimated cost, $40,000.

Mass., Malden—Potter Bros., 339 Main St., have awarded the contract for the construction of a 2 story, 80 x 115 ft. garage and service station on Main St. Estimated cost, $100,000. Noted March 24.

Mass., Northampton—F. Girard, King St., will build a 1 story, 100 x 125 ft. garage, etc., on North St. Private plans. Noted Sept. 15.

The Weekly Price Guide

This Week's Market

While quotations as low as $1.60@$1.70 on structurals have been reported, the official Pittsburgh base of $1.75 stands except for very large orders. Bars are $1.65. For sheets the Pittsburgh mill prices are: No. 28 black steel at $3 as against $2.75 and No. 10 blue annealed at $2.50 as compared with $2.25 per 100 lb., one week ago. Mill shipments, New York, of structural shapes and plates are quoted at $1.98@$2.03; soft steel bars at $1.88@$1.98 per 100 lb.

Slight advances in metal prices are reported in New York and St. Louis warehouses. Copper has advanced ⅛c., lead ¼c. and zinc ¼c. per lb. in quantities under car-load lots. Cleveland quotes aluminum at 25c. as against 25@26c. per lb. Brass rods have declined 50c. and brass tubing 2c.; while a reduction of 1c. per lb. on brass sheets and copper tubing, respectively, is reported in Cleveland warehouses.

Linseed oil is quoted in New York at 76c., as against 80c. per gal. (5-bbl. lots).

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	†22.52
Southern Ohio No. 2	†23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	†20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†22.76
Virginia No. 2	†28.74
Basic	†20.75
Grey Forge	†21.75
CHICAGO	
No. 2 Foundry local	†22.70
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	†22.96
Basic	†21.96
Bessemer	†21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	3.28	3.10	3.38
No. 12	2.60	3.33	3.15	3.43
No. 14	2.70	3.38	3.20	3.48
No. 16	2.80	3.48	3.30	3.58
Black				
Nos. 17 and 21	2.85	3.80	3.55	3.95
Nos. 22 and 24	2.90	3.85	3.60	4.00
Nos. 25 and 26	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11	3.00	4.00	3.75	4.15
Nos. 12 and 14	3.10	4.10	3.85	4.25
Nos. 17 and 21	3.40	4.40	4.15	4.55
Nos. 22 and 24	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of Sept. 16, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	68½	56	¾ to 1¼	39½	24½
LAP WELD					
2	61½	49	2	34½	20½
2½ to 6	65½	53	2½ to 4	37½	24½
7 to 8	62½	49	4½ to 6	37½	24½
9 to 12	61½	48	7 to 12	35½	22½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66½	55	1 to 1½	39½	25½
2 to 3	67½	56			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59½	48	2	35½	22½
2½ to 4	63½	52	2½ to 4	38½	26½
4½ to 6	62½	51	4½ to 6	37½	25½
7 to 8	58½	45	7 to 8	30½	18½
9 to 12	52½	39	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	46%	60½%	47½%	68½%	56%
3½ to 6 in. steel lap welded	51%	37%	58½%	44½%	65½%	53%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.00	8.25
Spring steel (light)	6.00	6.00	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.03	3.50	4.00
Cold finished flats, squares	4.53	4.00	4.50
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.78
Soft steel bar shapes (base)	2.78	2.64	2.78
Soft steel bands (base)	3.43	.....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%

Electric welding wire..... New York $\frac{3}{32}$, 8½c. per lb. ⅛—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			13.10
Tin, 5-ton lots, New York			27.25
Lead (up to carlots), St. Louis, 4.60; New York			5.00
Zinc (up to carlots), St. Louis, 4.85; New York			5.25
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25.00	21.00
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.50	19.50
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.00	22.00	17.50
Copper tubing (100-lb. lots)	19.50	22.00	19.50
Brass sheets (100-lb. lots)	15.25	17.00	15.25
Brass tubing (100-lb. lots)	18.00	18.00	18.00
Brass rods (1,000-lb. lots)	13.25	15.00	13.25
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.50	23.50	17.50
Babbitt metal (best grade)	70.00	37.50	32.00
Babbitt metal (commercial)	30.00	13.50	8.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machine rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	10.00
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	8.00
Lead, heavy	3.25	3.00	3.75
Lead, tea	2.00	2.00	2.75
Brass, heavy	5.00	5.00	7.50
Brass, light	4.00	3.00	4.50
No. 1 yellow brass turnings	4.50	4.00	5.00
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	21.50	.....	.....
IX,	20x28, 112 sheets	24.00	.....	.....
IXX,	20x28, 56 sheets	13.75	.....	.....
IXXX,	20x28, 56 sheets	15.50	.....	.....
IXXXX,	20x28, 56 sheets	17.00	.....	.....
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	18.50	.....	.....
IX,	20x28, 112 sheets	21.50	.....	.....
IXX,	20x28, 56 sheets	12.25	.....	.....
IXXX,	20x28, 56 sheets	14.00	.....	.....
IXXXX,	20x28, 56 sheets	15.75	.....	.....
Coke Plates, Bright				
Prime, 20x28 in.:		(56 sheets)		
80-lb,	112 sheets	13.60	.....	.....
90-lb.,	112 sheets	13.80	.....	.....
100-lb.,	112 sheets	14.00	6.50	.....
IC,	112 sheets	14.30	6.65	.....
IX,	112 sheets	16.30	.....	.....
IXX,	56 sheets	9.15	.....	.....
IXXX,	56 sheets	10.15	.....	.....
IXXXX,	56 sheets	11.15	.....	.....
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.50	6.25	6.25
IC,	14x20	7.75	6.50	6.50

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	—60–5%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	.....
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	.....	.....
Button head bolts, with hex. nuts	—20%	$3.90 base	.....
Hex. head and hex. nut bolts	—20%	.....	.....
Lag screws, coach screws	—50–10%	.....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	50–10–10%	50–5%
Bolt ends, with hot pressed nuts	—50%	.....	.....
Tap bolts, hex. heads	—20%	.....	.....
Rivets, 7/16 in. dia. and smaller. *New list*	–50-10%	60-10-10%	–60-10%
Rivets, tinned	–50-10%	60-10-10%	—45%
Semi-finished nuts, all sizes	—70%	75%	50%
Case-hardened nuts	—60%	.....	.....
Washers, cast iron, ⅜ in., per 100 lb.	$5.00	$5.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	.....	.....
Nuts, hot pressed, sq.	Off list	2.00	3.00	3.25
Nuts, hot pressed, hex.	Off list	2.00	3.00	3.25
Nuts, cold punched, sq.	Off list	1.50	3.00	3.00
Nuts, cold punched, hex.	Off list	1.50	3.00	3.00
Rivets:				
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb		$4.40	3.50	3.68
Cone heads, ditto		4.50	3.60	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb		0.25	.....	....
⅞ in. diameter	*EXTRA*	0.15	.....	....
½ in. diameter	*EXTRA*	0.50	.....	....
1 in. long, and shorter	*EXTRA*	0.50	.....	....
Longer than 5 in.	*EXTRA*	0.25	.....	....
Less than 200 lb.	*EXTRA*	0.50	.....	....
Countersunk heads	*EXTRA*	0.35	.....	....
Copper rivets		50–10%	40–10%	50%
Copper burs		25–10%	15%	20%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	.....	55.00	55.00
Wiping cloths per M., 13¼x20½	.....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.76	.88	.87
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 100 lb.		.80	.80
Coke, prompt furnace, Connellsville	per ton	$3.25@3.40	
Coke, prompt foundry, Connellsville	per ton	4.25@4.50	

Mass., Springfield—The Connery Machine Co., 56 Harrison Ave., plans to build a small shop.

R. I., Pawtucket—The Bd. Educ. plans to build a manual training and industrial arts school on Fountain St. Estimated cost, $1,200,000. Architect not selected.

MIDDLE ATLANTIC STATES

N. J., Mt. Holly—Folsom & Stanton, Archts., 10 South 18th St., Phila., Pa., will receive bids until Oct. 20 for the construction of a 1 and 2 story, 100 x 200 ft. garage and service station on Washington and King Sts., for W. A. Jones. Estimated cost, $70,000.

Pa., Philadelphia—The city plans to build traffic and van stables, also repair shops for the police department. Estimated cost, $250,000. F. C. Dunlap, City Hall, Engr.

Pa., Philadelphia — Egnal & Motusan Bros., 3d and Berks Sts., will build a 2 story, 74 x 120 ft. garage on Woodstock and Berks Sts. Estimated cost, $70,000.

Pa., Philadelphia—S. W. Evans & Co., 4623 Paul St., manufacturer of metal products, has awarded the contract for the construction of an addition to its factoryfl Estimated cost, $50,000.

Pa., Philadelphia—C. Goldman, 725 Walnut St., is having plans prepared for the construction of a 1 story, 54 x 200 ft. garage at 406-8 South Front St. Estimated cost, $60,000. H. B. Weldon, 10 South 18th St., Archt.

Pa., Philadelphia—A. Sabet, 3133 Frankford Ave., will receive bids until Oct. 15 for the construction of a 1 story, 41 x 185 ft. garage on Allegheny and Frankford Aves. Estimated cost, $40,000. Private plans.

MIDDLE WEST STATES

Ill., Cicero—J. M. Host has awarded the contract for the construction of a 1 story, 64 x 125 ft. garage. Estimated cost, $50,000.

Ill., Peoria—The Peoria Sheet Metal Co., c/o J. Freid, 2815 Main St., plans to build a 1 story factory. Estimated cost, $50,000. Architect not selected.

O., Cleveland—M. A. Gleason, 1625 Williamson Bldg., is receiving bids for the construction of a 1 story, 90 x 109 ft. garage at 6815 Superior Ave. Estimated cost, $40,000. Private plans.

O., Cleveland—Sobel & Elder, 416 Guardian Bldg., are receiving bids for the construction of a 1 story, 100 x 100 ft. garage at 2719 East 55th St. Estimated cost, $50,000. E. A. Curtiss, 605 Republic Bldg., Archt.

O., Cleveland—O. Uterhardt, 12203 Farrington Ave., has had plans prepared for the construction of a 1 story, 40 x 90 ft. garage at 3308 East 116th St. Estimated cost, $40,000. Private plans.

Wis., Green Bay—The Bd. Educ. plans to build a vocational school to include a fully equipped machine shop. Estimated cost between $250,000 and $300,000. A. W. Burton, Secy. Architect not selected.

Wis., Kilbourn—D. A. Colby plans to build a 2 story, 60 x 95 ft. garage and machine shop on Bway. Estimated cost, $45,000. Architect not selected.

Wis., Milwaukee—J. Wollaeger Co., 417 Wells St., is having plans prepared for the construction of a 4 story, 90 x 120 ft. garage on 28th and Grand Sts. Estimated cost, $95,000. M. Fernekes, 97 Wisconsin St., Archt.

Wis., Oshkosh—The Oshkosh Tractor Co., c/o A. D. Paine, 22 New York Ave., has awarded the contract for the construction of a 1 story, 150 x 375 ft. tractor factory. Estimated cost, $170,000. Noted Sept. 29.

Wis., Racine — The Harvey Spring & Forging Co., has awarded the contract for the construction of a 2 story, 58 x 60 ft. factory on 17th St. and Murray Ave. Estimated cost, $40,000. Noted Sept. 8.

Wis., Racine—The West Racine Garage & Implement Co., 3218 Washington Ave., has awarded the contract for the construction of a 1 and 2 story, 60 x 90 ft. garage and machine shop on Washington Ave. Estimated cost, $40,000.

Wis., Saukville—A. Horn has awarded the contract for the construction of a 1 and 2 story, 65 x 110 ft. garage and repair shop on Main St. Estimated cost, $40,000. Noted Sept. 29.

WEST OF THE MISSISSIPPI

Kan., Parsons—The Missouri, Kansas & Texas Ry., Ry. Exch. Bldg., St. Louis, Mo., is having plans prepared for the construction of a 1 story reclamation plant, here. Estimated cost, $166,000. A. L. Sparks, care of owner, Archt.

Mo., St. Louis—The Plymouth Garage Co. 5909 Plymouth St., has awarded the contract for the construction of a 1 story, 75 x 80 ft. garage on Plymouth and Hamilton Sts. Estimated cost, $50,000. Noted Sept. 8.

Mo., St. Louis — The St. Louis & San Francisco Ry. Co., Frisco Bldg., will receive bids until Oct. 11 for the construction of a 1 story, 40 x 123 ft. machine shop at Chateau Ave. yards. Estimated cost, $55,000. R. C. Stephens, care of owner, Archt.

WESTERN STATES

Mo., Joplin—Rogers Fdry. Co., 11th and Pearl Sts., has had plans prepared for the construction of a 1 story, 80 x 100 ft. foundry on West 10th St. Estimated cost, $30,000. Private plans.

Mo., St. Louis—J. Forshaw Stove & Heating Co., c/o J. Forshaw, Pres., 111 North 12th St., plans to build a 7 story, 25 x 100 ft. factory at 109 North 12th St. Estimated cost, $75,000. Architect not selected.

Ore., Klamath Falls—The Klamath Iron & Steel Wks., Inc., plans to rebuild its foundry which was recently destroyed by fire. Estimated loss, $15,000. B. M. Hall, Mgr.

Utah, Salt Lake City — The Utah Steel Corp. has increased its capital stock from $750,000 to $5,000,000 and plans to build additions to present mills, new blast furnace and sheet steel mill. M. S. Rosenblatt, Genl. Mgr.

CANADA

Que., Montreal—Bramsons Auto Service, Ltd., Phillips Sq., has awarded the contract for the construction of a 6 story, 50 x 90 ft. garage on Ontario St. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Cheshire—The Connecticut State Reformatory has awarded the contract for the construction of a 1 story industrial school at reformatory, here. Estimated cost, $45,000.

Me., Richmond — The Damariscotta Leather Co. will build a 3 story, 65 x 201 ft. mill. Estimated cost, $100,000. Private plans.

Mass., Adams—The Renfrew Mfg. Co., manufacturer of ginghams, is receiving bids for the construction of a 1 and 2 story, 83 x 107 ft. picker, storage and office building. Estimated cost, $75,000. A. F. Gray, 53 State St., Boston, Archt.

Mass., Waltham—The Elastoid Fibre Co. has awarded the contract for the construction of a 1 story, 72 x 181 ft. factory. Estimated cost, $60,000.

R. I., Woonsocket — The Lafayette Worsted Co., Hamlet Ave., has awarded the contract for the construction of a 6 story, 136 x 246 ft. worsted factory on Hamlet Ave.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Western Maryland Dairy Co., Linden Ave., has awarded the contract for the construction of a 4 story, 100 x 165 ft. dairy plant on Linden and Dolphin Sts. Estimated cost, $500,000. Noted Aug. 1.

Pa., Philadelphia—F. W. Tunnell & Co., 15 North 5th St., has awarded the contract for the construction of a fertilizer plam on Wheat-sheaf Lane and Gual St. Estimated cost, $150,000.

Pa., Philadelphia—C. Wacker Co. will build a 1 story, 43 x 77 ft. wagon factory at 1304-6-8 West Cumberland St. Estimated cost, $15,000.

SOUTHERN STATES

N. C., Asheville—The Asheville Power & Light Co., has awarded the contract for the construction of a gas generating plant. Estimated cost, $200,000.

MIDDLE WEST STATES

O., Canton—Schory & Schellhase Co., 6th St. and Harrison Ave., S.W., plans to build a 2 story, 60 x 200 ft. ice plant on Harrison and 6th Sts., S.W. Estimated cost, $250,000.

O., Cleveland—The City Ice & Fuel Co., Cadillac Bldg., has awarded the contract for the construction of a 1 story, 52 x 75 ft. ice plant on Addison Rd. Estimated cost, $100,000. Noted Sept. 29.

O., Youngstown—The Distilled Water Ice Co., 523 West Federal St., has awarded the contract for the construction of a 1 story, 70 x 160 ft. ice plant on Federal St. Estimated cost, $100,000. Noted Sept. 29.

Wis., Kansasville—The Spring Valley Sanitary Milk Co. has awarded the contract for the construction of a 2 story addition to its pasteurizing plant. Estimated cost, $15,000.

Wis., Milwaukee—The Holeproof Hosiery Co., 41 4th St., has awarded the contract for the construction of a 3 story, 58 x 150 ft. factory on 30th St. Estimated cost, $100,000.

Wis., Milwaukee—E. R. Liebert, Archt., 432 Bway., will open bids about Oct. 10, for the construction of a 1 story, 35 x 42 ft. addition to the still house of the Natl. Distilling Co., 27th St. and St. Paul Ave. Estimated cost, $10,000.

Wis., Nelsonville—H. J. Kaukrud is having plans prepared for the construction of a 2 story, 48 x 130 ft. saw mill. Estimated cost, $55,000. Private plans.

Wis., North Milwaukee—J. Greenebaum Tanning Co. has awarded the contract for the construction of a 2 story, 45 x 70 ft. addition to tannery. Estimated cost, $35,000. Noted Sept. 1.

WEST OF THE MISSISSIPPI

Kan., Coffeyville—F. R. Lawson, Nowata, Okla., is having plans prepared for the construction of a 2 story ice plant here. Estimated cost, $100,000. Architect not announced.

Mo., Kansas City—The Superior Ice Co., c/o A. L. Williams, Lee Bldg., is having plans prepared for the construction of a 3 story ice storage plant on 2nd and Main Sts. Estimated cost, $150,000. B. B. Ryan, care of owner, Archt.

Okla., Oklahoma City—The Smith Baking Co., 437 West Park St., is having plans prepared for the construction of a 2 story, 100 x 150 ft. bakery on 39th and Oklahoma Aves. Estimated cost, $150,000. Noted Sept. 15.

WESTERN STATES

Cal., Los. Angeles—Keeler Comey Co., c/o G. W. Eldredge, Archt., 226 Pacific Finance Bldg., has awarded the contract for the construction of a 2 story, 125 x 240 ft. ice cream plant on San Pedro St. Estimated cost, $600,000.

CANADA

N. B., Bathhurt—The Bathurst Co., Ltd., is having plans prepared for the construction of a lime plant, including 2 Meade kilns equipped with automatic stokers and induced draft. R. K. Meade & Co., 11-13 East Fayette St., Baltimore, Md., Engrs.

Que., Montreal—The Dominion Oxygen Co., Burgess St., has awarded the contract for the construction of a 1 story, 82 x 101 ft. plant on Liber and Burgess Sts. Estimated cost, $40,000. Noted July 21.

Que., Montreal—Molsons Brewery, 906 Notre Dame St., plans to build a 6 story, 91 x 124 ft. brewery on Notre Dame St., E. Estimated cost, $119,000.